WIRE

AUGUST 1941

AND WIRE PRODUCTS

YOU'LL NOTICE THE DIFFERENCE

HERE

WITH

J&L *Mastercraft*

SPRING WIRE

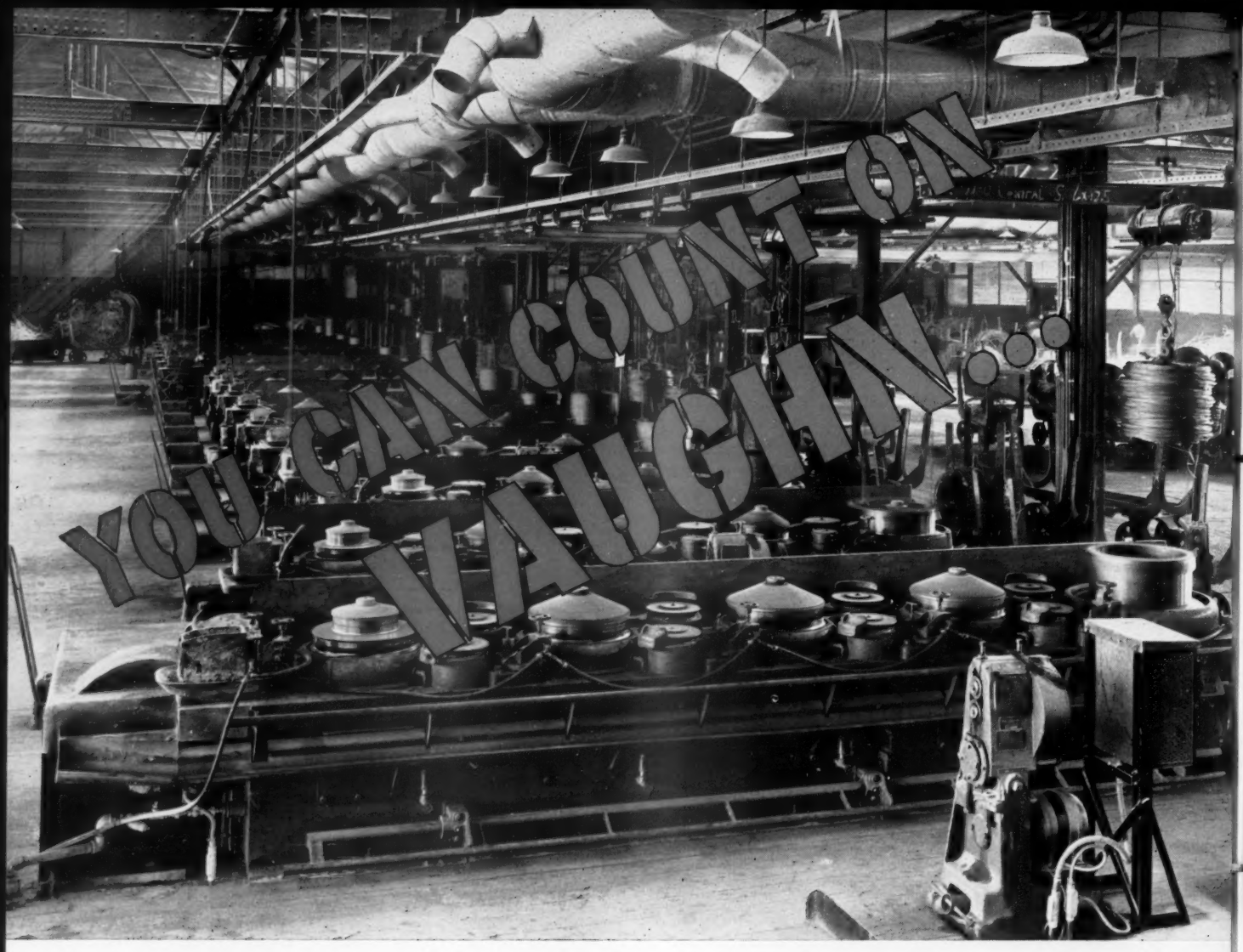
Users acclaim the uniformity and especially the unique surface finish of J&L Mastercraft spring wire because it is these features that makes it work better through the wire guides, rolls, spreaders, mandrels, nose pieces and other tools of automatic coiling and knotting machines.

JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS · PITTSBURGH, PENNSYLVANIA

J&L STEEL

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION



for the *Performance*

you need in today's
WIRE DRAWING OPERATIONS

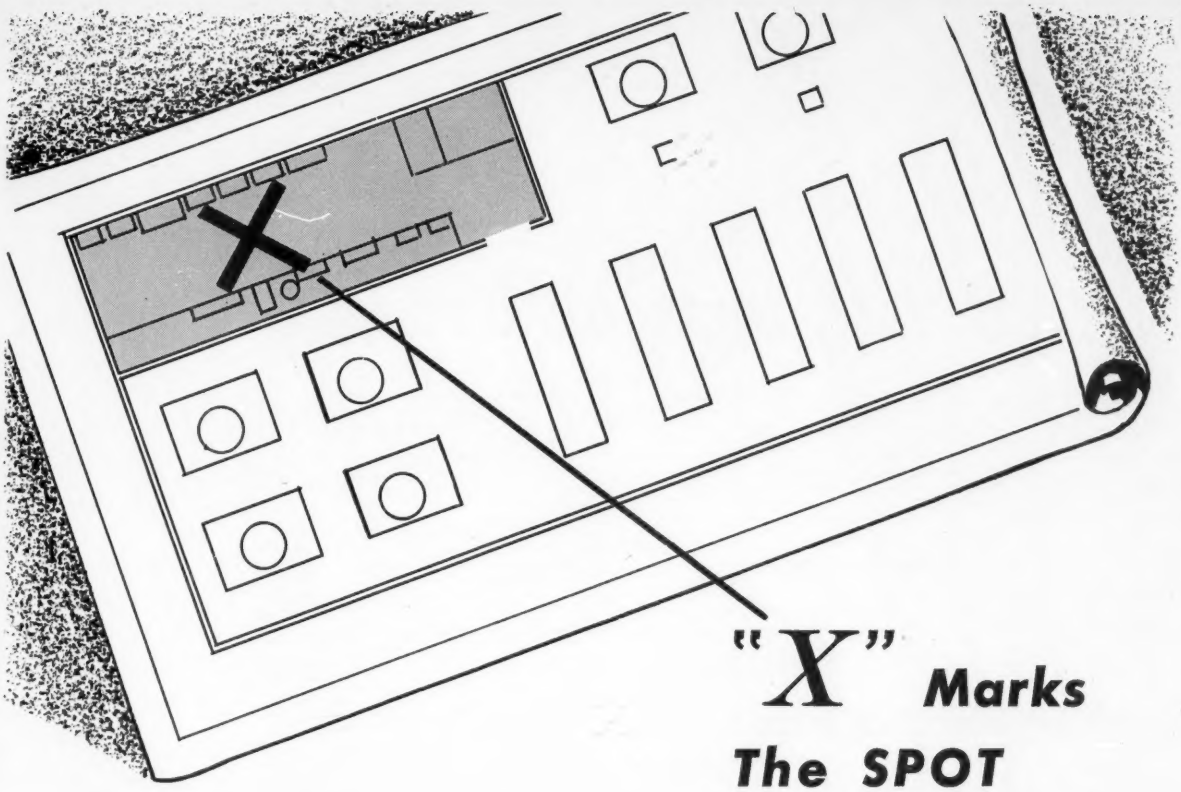
Built by specialists, to the single objective of producing the finest in wire drawing machinery, VAUGHN Motobloc and Motoblox supply every performance feature that specialized engineering and specialized precision manufacture can develop . . . providing *trouble-free wire production* on the toughest schedules encountered in the industry today.

COMPLETE WIRE DRAWING EQUIPMENT

CONTINUOUS OR SINGLE HOLE . . . FOR THE LARGEST BARS . . . FOR THE SMALLEST WIRE . . . FERROUS, NON-FERROUS MATERIALS OR THEIR ALLOYS

THE VAUGHN MACHINERY COMPANY

CUYAHOGA FALLS, OHIO, U. S. A.



"X" Marks The SPOT Where Production Starts and Stops!

In most mills a considerable period of years has passed since the original installation of a special die room system for handling carbide dies.

During recent months it has been the privilege of our die service men to again work with the die room personnel in many of these plants. This service has been provided in order that we may assist your own die service men in reviewing their present technique and handling system. In this way any further improvement that may seem desirable under today's peak production conditions can be more readily incorporated in a minimum of time.

We'd be glad to take the time to provide this service for your mill too. There is no obligation—and we believe you'll find it particularly helpful—and effective.

CARBOLOY COMPANY, INC., DETROIT, MICH.

CHICAGO • CLEVELAND • NEWARK • LOS ANGELES
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Authorized Distributors: Canadian General Electric Co., Ltd., Toronto, Canada • Hartley Wire Die Co., Thomaston, Conn.

CARBOLOY REG. U.S. PAT. OFF. **DRAWING AND SIZING DIES**

Engineering facts on bethanized wire

HOW IT IS MADE:

Bethanized wire is zinc-coated by electrolysis. The uncoated wire enters a long tank or "cell" containing a solution of zinc sulphate. A high-density electric current flows through this solution depositing pure zinc, particle by particle, on the wire. The result is the bethanized coating—a wall of 99.9+ per cent pure zinc.

ITS ADVANTAGES:

Bethanized wire may be wrapped around its own diameter, bent flat back upon itself, twisted into a pigtail, or drawn through dies to a fraction of its size—without loosening, flaking or harming the bethanized coating in any way.

A bethanized zinc coating is uniformly thick both along and around the wire. It is impossible to apply a spotty or lopsided zinc coating by the bethanizing process.

A bethanized zinc coating may be obtained twice or three times as heavy as a standard "double galvanized" coating.

WHERE TO USE IT:

Use bethanized wire wherever you have a severe forming operation, or wherever corrosive conditions are particularly severe. The bethanized zinc coating will stand virtually any kind of forming without flaking or peeling. In the heavier coating weights, bethanized wire affords greater-than-average corrosion resistance.

Partial list of applications:

Conveyor belting
Brush handles
Mattress springs
Box reinforcing
Baby carriage spokes
Milk crate bottle divisions
Clothes lines
Coat hangers
Vineyard wire
Cot link fabric
Chain link fence
Pail bail wire
Pump chain
Woven fabric
Wooden pipe reinforcing
Helical springs
Telephone wire

Write to Bethlehem Steel Company, Bethlehem, Pa. for free folder describing bethanized wire in detail.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

NIGHT LIFE
in a Grinding Wheel Plant

The new Plant 1 (left) replaced the original building at the Norton plant in 1939.

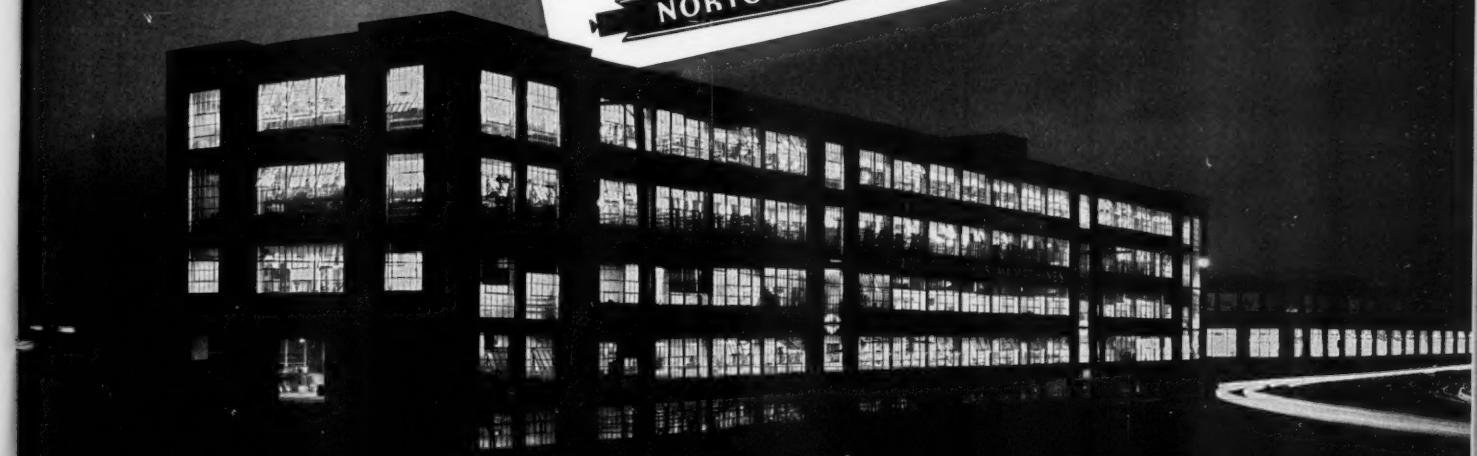
The new Plant 3 (right) replaced the former building in 1938.

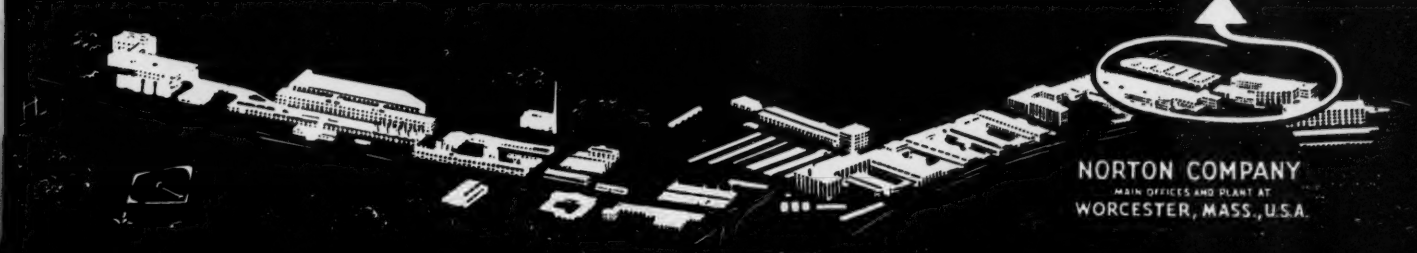
New Abrasive Storage buildings built in 1941.

Total additional floor space, 7.6 acres, completed this year.

New tunnel kilns, new facilities, larger payroll, day and night operation, have stepped up production.

NORTON ABRASIVES





NORTON COMPANY
MAIN OFFICES AND PLANT AT
WORCESTER, MASS., U.S.A.

PLAN TO ATTEND

THE NATIONAL METAL CONGRESS
and to ADVERTISE in the
ANNUAL CONVENTION NUMBER OF

WIRE AND WIRE PRODUCTS

Reserve advertising space now in the October Convention Issue. It is the high-spot of the year — so don't fail to be represented.

WIRE and WIRE PRODUCTS will carry your advertising story into every wire mill in the country — and to most mills in the far corners of the earth. And will reach in addition every important wire products fabricator — those who buy wire on a tonnage basis.

✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦

These mills and factories are a great market and are important cogs in America's defense work. Without wire, armies cannot move, civilians cannot live, so closely is the use of wire knit into every activity and product — land, sea and air.

✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦

And while you are busy today — asked to do more than physically possible — the wise man will hold his sales organization together, maintain his customer contacts, and advertise to hold his customers' good-will against the day when he will need every ounce of it. The great majority of those comprising the wire industry — those who make wire, who make wire products, and those who make machinery and supplies for it, are wise men.

✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦

So if you have a new aid to production, a better metal, a more efficient machine, a speedier way to process metals, plan to sell the vital and immense metals industry, of which wire is an important integral part, through WIRE and WIRE PRODUCTS.

Especially plan to use the October Convention Number with your sales story.

• • •

CULTIVATE THE WIRE and WIRE PRODUCTS INDUSTRY

through advertising in

WIRE and WIRE PRODUCTS

Don't put it off—write today for details.
Better yet, just send your order and copy.

WIRE AND WIRE PRODUCTS
300 MAIN STREET
STAMFORD, CONN.

WHAT THE WELL-DRESSED FOWL WILL WEAR

Skewers, such as those in the roast below, are but one of the hundreds of ways Continental SUPERIOR wire may be used in the manufacture of everyday items. Continental wire is produced in sizes from 34 gauge to ⅝-inch . . . and in correct analyses, tempers and coatings to fill exacting requirements and improve products.

WIRE FOR A THOUSAND USES

SKEWERS may be a far cry from the product you manufacture, but they illustrate the adaptability of Continental SUPERIOR Wire to the job at hand. The different combinations of sizes, shapes and finishes available in Continental wire are numbered in thousands.

Whenever you have a problem that calls for a special shape of wire or wire for some unusual fabricating job, call on Continental. It is our business to provide you with the exact type of wire that will assure you smoother, faster production.

CONTINENTAL STEEL CORP., KOKOMO, INDIANA

(The Superior Sheet Steel Co., Canton, Ohio—a subsidiary)

CONTINENTAL STEEL CORPORATION ★ SUPERIOR WIRE

CONTINENTAL STEEL CORPORATION

SHEETS: Black, Galvanized, Copperior, Hot and Cold Rolled, Special Coated, Long Terne, etc.

WIRE: Bright Basic, Annealed, KONIK, Copperad, Tinned, Special Manufacturer's, etc.

I NEVER MISS ONE!
I'LL GET SOME NEW IDEAS!
AND SWELL ENTERTAINMENT!
PUTS NEW LIFE IN YER!
AND BIG EATS!
GREAT CHANCE TO SWAP IDEAS
TO THE CONVENTION

Are You Coming To Philadelphia October 20-24, 1941

To Attend
The Eleventh Annual Convention
of the
Wire Association?

Technical Papers Will Be Preprinted in the October, 1941 Issue of Wire and Wire Products

✦ ✦ ✦

The Discussions and the Mordica Memorial Lecture Will Be Printed in the January, 1941 Issue of Wire and Wire Products

The Program Will Include Research Papers On:

"The Effects Of Microstructure on the Galvanizing Characteristics of Steel"

"Time, Temperature and Size in the Heating of Steel Wire."

"Manufacture of Steel for Arc Welding Electrodes."

"High Speed Rotary Knitting Machine for Covering Electrical Conductors."

"Tungsten Carbide Dies."

"Diamond Dies for the High Speed Drawing of Copper Wire"

"Aircraft Wire."

"Wire Cloth Manufacture"

The Mordica Memorial Lecture ✦ ✦ ✦ ✦ ✦ **By Kenneth B. Lewis**

The Annual Luncheon With Addresses By Speakers of National Reputation
Topic:—"National Unity and National Defense."

National Defense Session — F. A. Westphal, Past President, Speaker

✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦

The Smoker | The National Metal Congress | The A.S.M. Dinner

MAKE YOUR PLANS NOW TO ATTEND:—

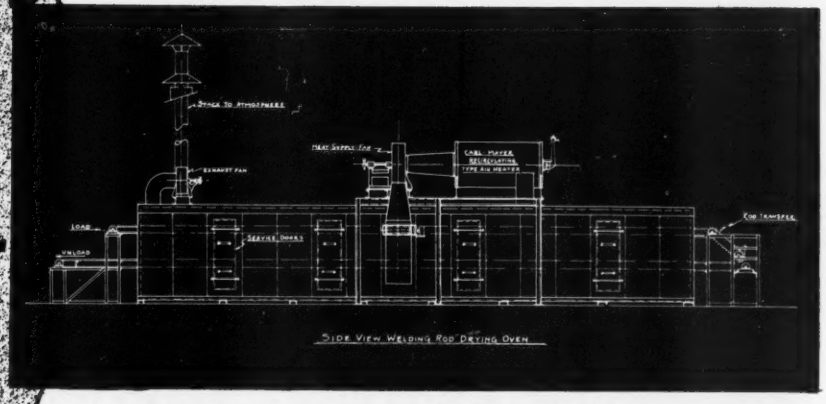
For Detailed Information on Program, Membership, Hotel Reservations and Transportation.

Address RICHARD E. BROWN, Executive Secretary,
300 MAIN STREET **STAMFORD, CONN.**

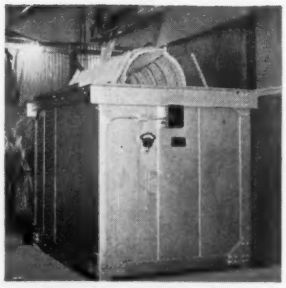
★ OTHER SOCIETIES PARTICIPATING:
THE AMERICAN SOCIETY FOR METALS
THE INSTITUTE OF METALS DIVISION, A.I.M.E.
THE AMERICAN WELDING SOCIETY
THE IRON AND STEEL DIVISION, A.I.M.E.

Another for Hollup Corp!

Carl-Mayer WELDING ROD OVEN



Owing to policies of concerns in this industry, photographs are not permitted.



PATENT NOS.
U. S. A. 2235559
Canada 396144
Canada 465969
Other patent claims allowed and pending.

● Repeat orders are not only a voice of satisfaction, but of preference! The Hollup Corporation's choice of Carl-Mayer Welding Rod Coating Baker for the second time, and duplicate installations at the Page Steel & Wire Co., etc., are surely an endorsement of Carl-Mayer's outstanding engineering ability.

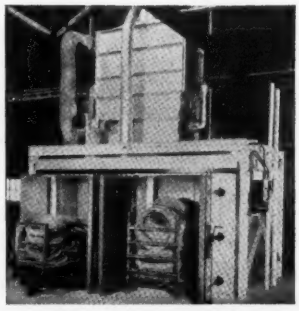
We build a fast drying multiple level conveyor type Welding Rod Coating Baker (patents pending) for capacities up to 600 rods per minute.

ROD BAKERS:

At Steel Company of Canada's plant at Hamilton, Ont. The performance of first installation, shown above, resulted in second order from same plant. These HI-SPEED Rod Bakers are selling themselves by much faster baking time and up to 50% saving in fuel — through exclusive patented features.

A Few Carl-Mayer Customers

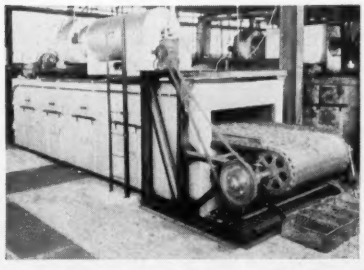
Allegheny Ludlum Steel Co.
Atlantic Wire Co.
Atlas Steel Co.
Johnson & Nephew, Limited
Pittsburgh Tool Steel Wire Co.
Steel Co. of Canada
Wickwire Spencer Steel Co.



WIRE BAKERS

Carl-Mayer Tunnel Bakers at the Pittsburgh Steel Tool Co. These bakers have the same efficient heating system as applied to our HI-SPEED Rod Bakers.

THE CARL-MAYER CORP.
3030 Euclid Ave. Cleveland, Ohio



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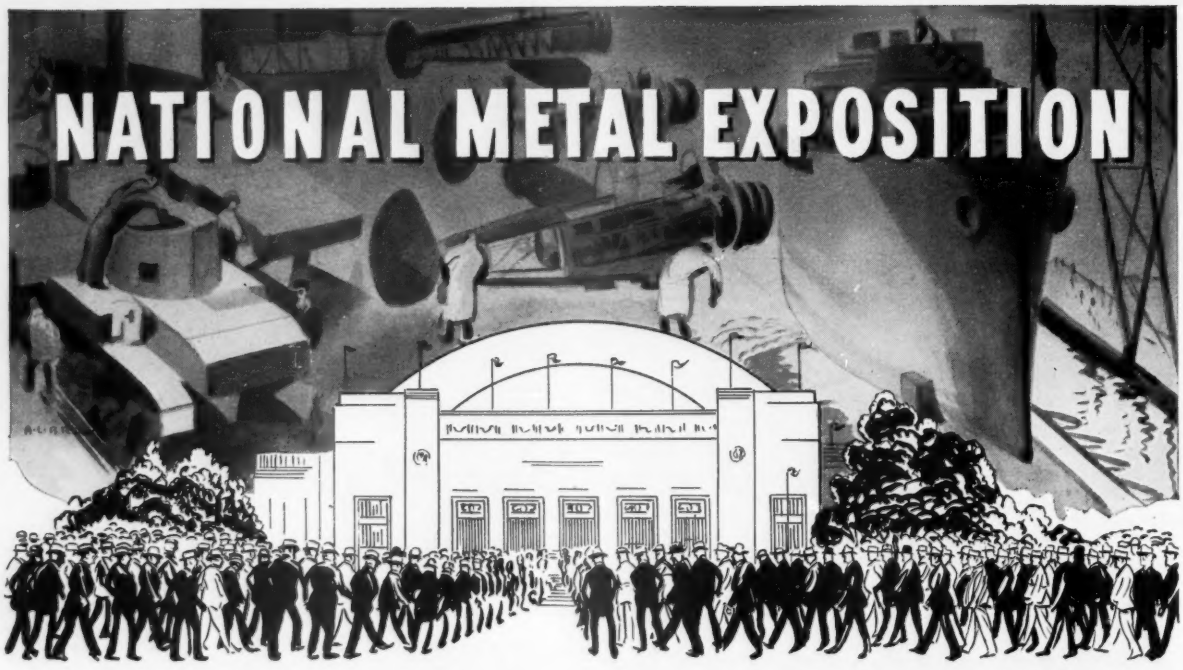
For stress relief, drawing, tempering and heat treating a variety of products. Temperatures at 1300 F. Uniformity 2½ F. Installations at Timken, Ford Motor, Hyatt, Bridgeport Brass, Heywood Wakefield, Aluminum Co. of America, American Magnesium Corp., and other outstanding concerns.

Over 20 Years' Experience

IN BUILDING ALL TYPES OF INDUSTRIAL OVENS AND FURNACES



GOES ALL-OUT FOR DEFENSE

This year's 23rd annual Metal Congress and Exposition is going "all-out" for defense — giving the nation's defense producers a chance to take stock of their progress and study new methods and equipment for speeding defense preparations.

Each morning during the week of October 20th one of the government's leading executives will address the Metal Congress on defense progress and requirements in Army, Navy, Aircraft and civilian production. During the afternoon and evening sessions of the Congress, round-table discussions on the most important phases of armament production will be headed by armament experts.

These important sessions will attract thousands of "big-guns" in national defense production to Philadelphia's Public Auditoriums where more than 275 manufacturers will display their products at the Metal Exposition.

If you have a new aid to production . . . a better metal . . . a more efficient machine . . . a speedier way to process and fabricate metals . . . you should plan to sell the 20 billion dollar metal industry through an exhibit in its biggest annual event.

Advance reservations are the heaviest in history; however, choice locations are still available at the regular $1.00 a square foot rate, so write, telephone or wire collect today for floor plan and full particulars. Address: W. H. Eisenman, Secretary, American Society for Metals, 7319 Euclid Avenue, Cleveland, Ohio.

Cooperating Societies

American Society for Metals Wire Association American Welding Society
Institute of Metals & Iron and Steel Divisions of American Institute of Mining and Metallurgical Engineers

OCT. 20-24

NATIONAL METAL CONGRESS AND EXPOSITION

PHILADELPHIA PUBLIC AUDITORIUMS

Managed by THE AMERICAN SOCIETY FOR METALS

No Score!

This enlarged illustration (made from an original photograph) shows clearly the influence of dies on smooth finish of No. 13 bronze wire (92% copper, 8% tin). The wire above, at left, scored and out of round, was drawn through a "straight tungsten carbide die." Wire at right was drawn through a Vascoloy-Ramet tantalum-tungsten carbide die which had been in service the same length of time as the other die, operating under identical conditions.

IS THE PERFECT SCORE IN WIRE DRAWING

More mills are proving every day that Vascoloy-Ramet Dies produce a finer finish and at the same time wear longer than ordinary carbide dies.

The same properties of Tantalum-tungsten carbide which have won universal recognition in cutting tools are even more important and beneficial in wire dies. The presence of tantalum carbide in Vascoloy-Ramet Dies minimizes the tendency of wire to adhere to the die, thus putting an end to galling and scoring.

For a scoreless finish, with long runs on your side, specify Vascoloy-Ramet Dies every time.

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NORTH CHICAGO, ILLINOIS

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and

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Vascoloy RAMET

T. M. REG. U. S. PAT. OFF.

THE SUPERIOR TANTALUM-TUNGSTEN CARBIDE DIES

This Wire Drawing Machine is PREPARED FOR PREPAREDNESS

In operation, a real production machine, designed to draw high carbon (as well as low carbon) stock continuously at high speeds.

In construction, a typical Morgan product, built stronger than necessary. Compact, unit powered, equipped with modern safety features, the Morgan-Connor Continuous Wire Drawing Machine is a real producer, with an extra factor of safety *and profit* for you.

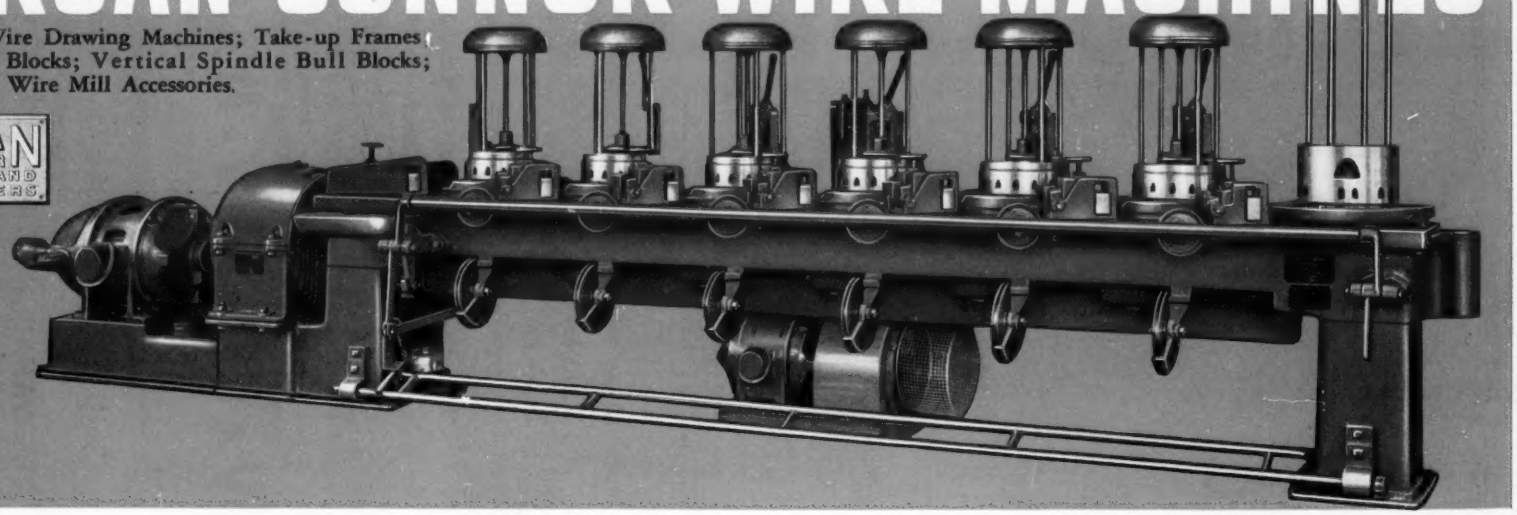
MORGAN CONSTRUCTION COMPANY
WORCESTER, MASSACHUSETTS

MORGAN-CONNOR WIRE MACHINES

Continuous Wire Drawing Machines; Take-up Frames; Horizontal Bull Blocks; Vertical Spindle Bull Blocks; Reels; Pointers; Wire Mill Accessories.

MORGAN
WORCESTER
ENGINEERS AND MANUFACTURERS

W-64



WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable

DRAWING—ROLLING—EXTRUDING—FORMING—FABRICATING

Vol. 16 AUGUST, 1941 No. 8

Designated as

Official Publication By The Wire Association

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—ASSOCIATE EDITORS—

Kenneth B. Lewis, Consulting Wire Mill Engineer
W. H. Spowers, Jr., Consultant on Galvanizing
Lancaster, Allwine & Rommel, Consultants on Patent Information

Richard E. Brown, General Manager
R. S. Spengel, Business Manager
E. D. Sickels, Advertising Manager

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ARE YOU COMING TO PHILADELPHIA, PA. OCTOBER 20-24, 1941

To Attend The Eleventh Annual Convention of the Wire Association?

✦ ✦ ✦

CONVENTION HEADQUARTERS WILL BE AT THE HOTEL PHILADELPHIAN

✦ ✦ ✦

A splendid opportunity is offered to discuss informally, routine production problems and to exchange opinions and ideas regarding equipment and processes used in the industry.

For this purpose informal gatherings are held at the Wire Association headquarters in the Hotel Philadelphian, which are open from 9 A. M. to 11 P. M. during the convention.

Every wire production executive engaged in the manufacture or fabrication of wire and wire products of any kind is invited to join The Wire Association and attend these meetings.

✦ ✦ ✦

THERE WILL BE A REGISTRATION FEE OF $5.00

✦ ✦ ✦

MAKE YOUR PLANS NOW TO ATTEND

✦ ✦ ✦

For detailed information on Program, Membership, Hotel Reservations and Transportation

Address RICHARD E. BROWN, Executive Secretary

300 Main Street Stamford, Conn.

"Keep 'em flying..."

USE FIRTHALOY DIES FOR PRECISION COLD HEADING OF AIRCRAFT PARTS

Aeroplane manufacturers with cold heading departments were among the first to recognize that FIRTHALOY Heading Dies maintain the *minutely accurate* tolerances that are absolutely essential in the production of aircraft parts.

Suppliers, serving this necessarily critical industry, also know that FIRTHALOY assures acceptance with practically no rejections where undeviating accuracy and improved finishes are involved.

No less vital—FIRTHALOY'S amazing resistance to wear results in longer, uninterrupted runs at high speeds. Just as FIRTHALOY Draw Dies are now used by 75% of the nation's wire plants, so FIRTHALOY Cold Heading Dies are enjoying increasing recognition for their ability to give "all out" performance in every phase of defense production.

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McKEESPORT, PENNA.

New York · Chicago · Hartford · Philadelphia
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FIRTH-STERLING FIRTHALOY QUALITY

FIRTHALOY SINTERED CARBIDE DIES

WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip.
Wire Products and Insulated Wire and Cable.
DRAWING --- ROLLING --- EXTRUDING --- FORMING --- FABRICATING

Vol. 16 AUGUST, 1941 No. 8

Determination of Spheroidizing Cycles In New Annealing Department

By H. L. Hopkins,

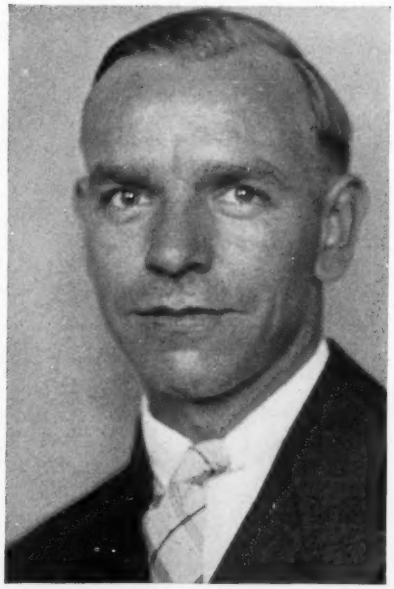
Plant Metallurgist and Superintendent, Plant No. 2,
National Screw & Manufacturing Co., Cleveland, Ohio.

WHEN the new bell type furnace installation was completed in the #2 plant of the **National Screw & Mfg. Company,** of Cleveland, some 15 months ago, the point immediately rose as to how these units could be operated most efficiently to meet the metallurgical requirements of having the softest steel in a minimum of time.

✦ ✦ ✦

THE furnace installation consisted of two **Lee Wilson** bell type units and five bases, Fig. No. 1, (it is now three furnaces and six bases) and was installed to anneal and spheroidize rods and wire coils ranging in analysis from SAE 1010 to SAE 2330, with most emphasis to be laid on SAE 1035 steel. Now determination of material softness according to percentage of total spheroidization is considered to be a difficult point of comparison and involves preparation of samples for microscopic study.

THE purpose in making this installation was to make the material as soft as possible for cold heading operations, so it was decided to set up cycles which would produce ultimate tensile stresses, for say for #1035 steels, of 67,000 lbs. per sq. in. or lower, and use this as the determining factor in setting up cycles rather than the grain structure study method.



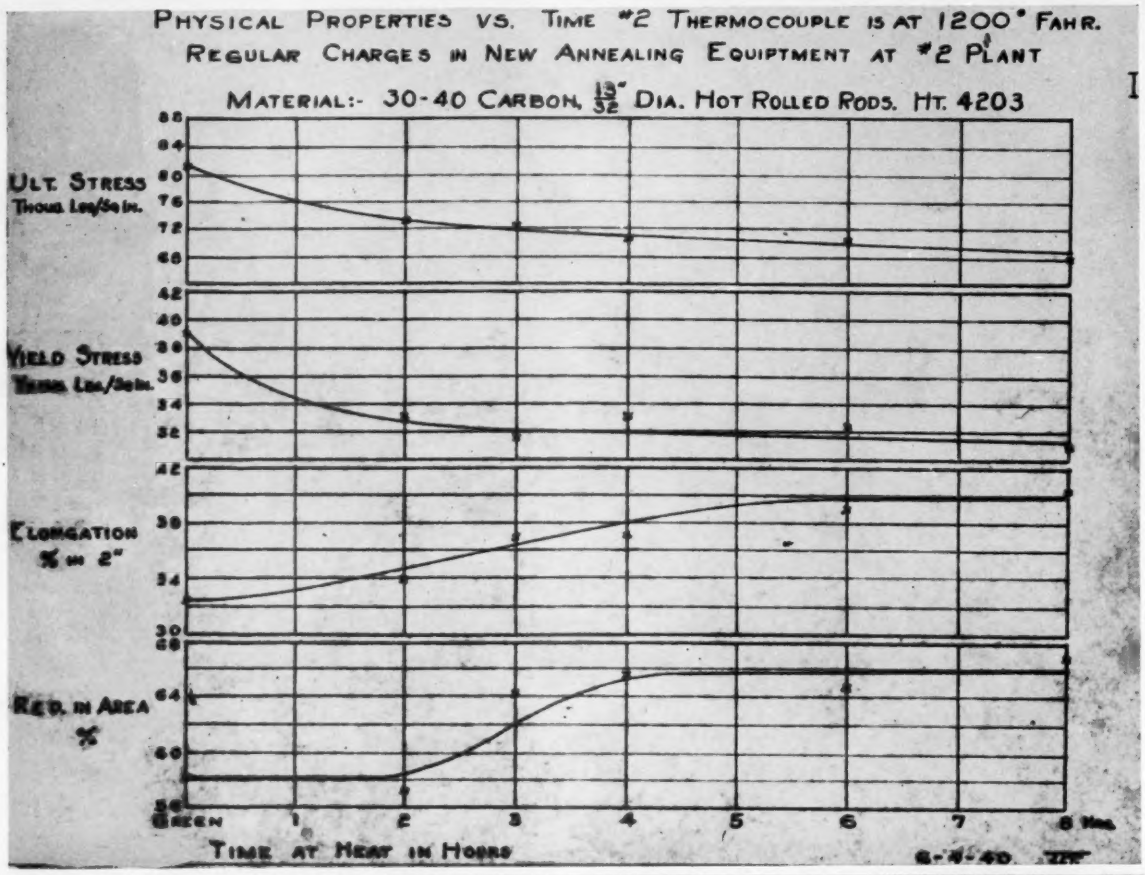
HOWARD L. HOPKINS

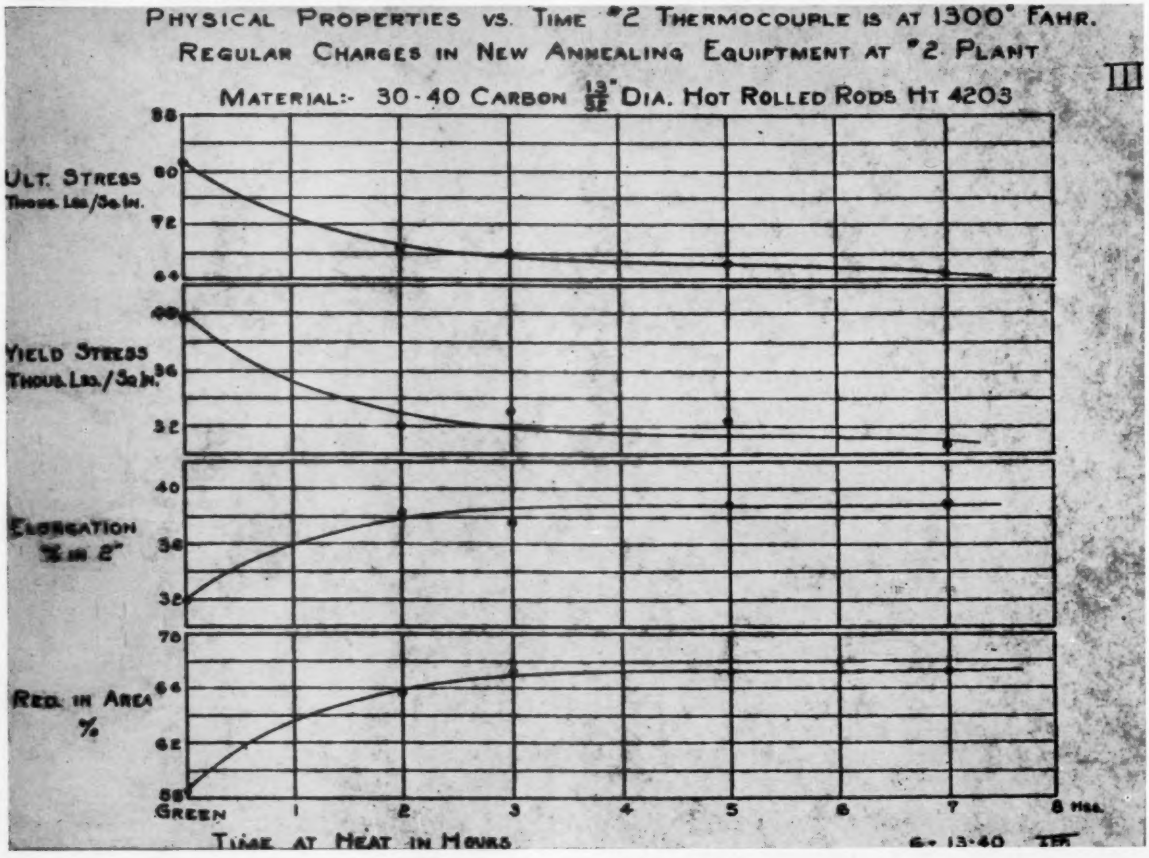
Graduated from Case School of Applied Science 1930; Alloy development at Aluminum Company of America Research Laboratories 1930-1935; Metallurgist for The National Screw & Manufacturing Company, Cleveland, Ohio, 1935 to-date. Member of The Wire Association, The American Society for Metals.

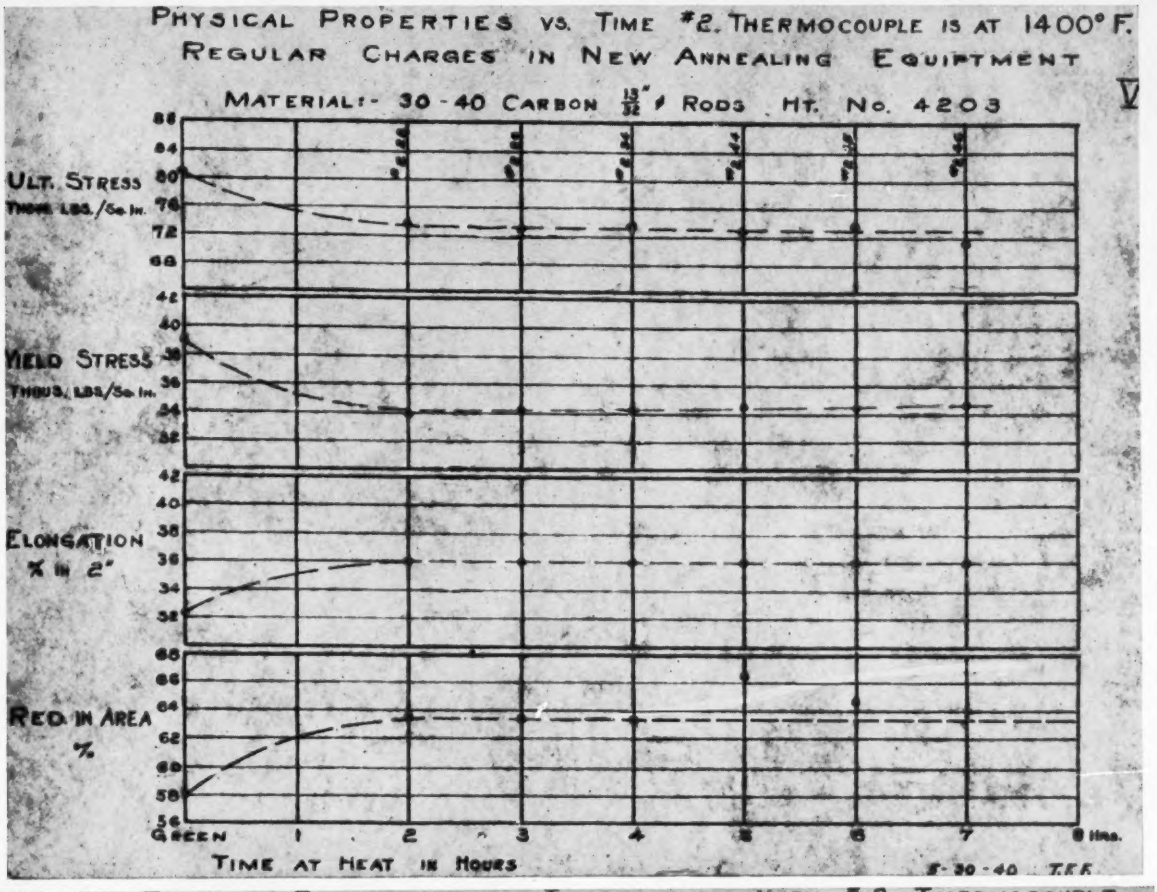
✦ ✦ ✦

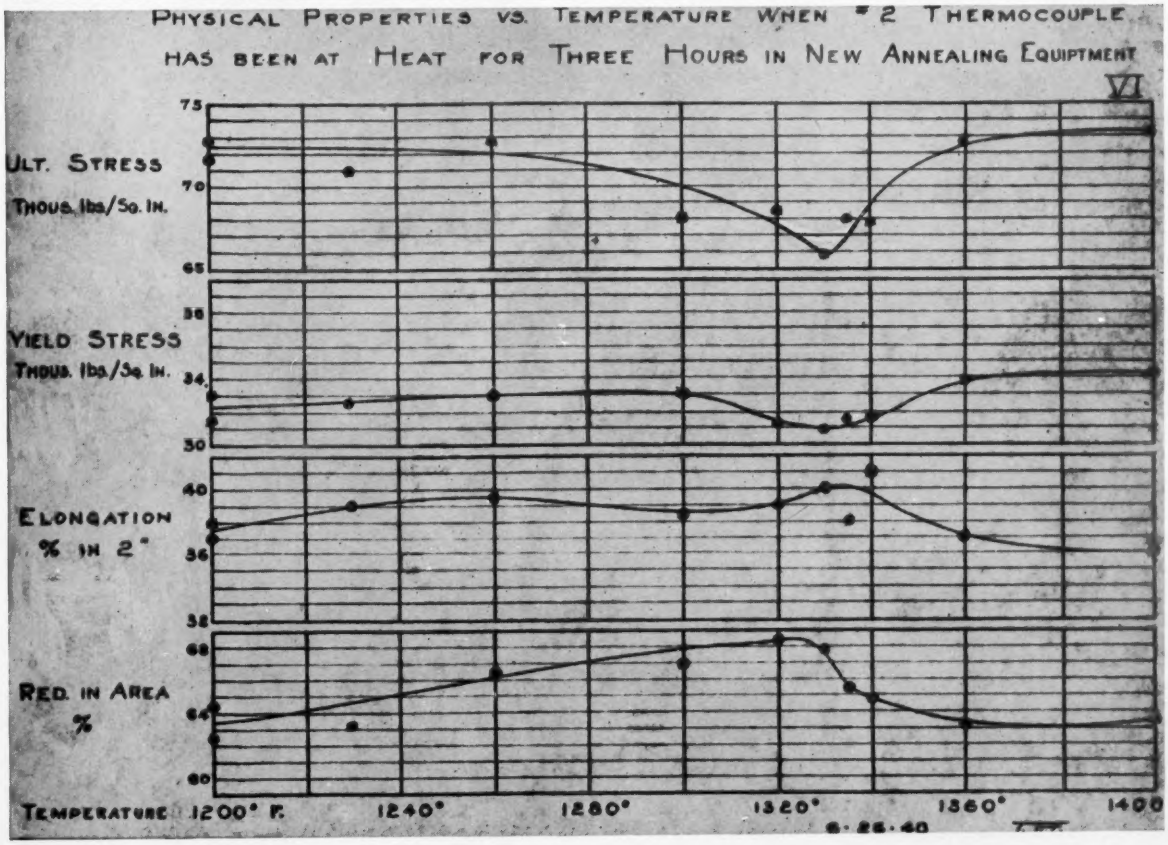
EXPLORATION of the most efficient cycles for operation of these furnaces meant that first, the proper temperature had to be determined and second, the proper soaking time had to be selected, i.e., the time which the charge was to be held at temperature after all parts of the charge had reached the desired point, since uniform spheroidizing depends on uniform temperature application to the charge. Of course these two factors could be different for all steels of different analyses so the process would have to be applied to all the different steels to be treated, and this was done. How-

Designated as Official Publication by the Wire Association


PHYSICAL PROPERTIES VS. TIME #2 THERMOCOUPLE IS AT 1200° FAHR.
REGULAR CHARGES IN NEW ANNEALING EQUIPTMENT AT #2 PLANT
MATERIAL:- 30-40 CARBON, 13/32" DIA. HOT ROLLED RODS. HT. 4203
I
ULT. STRESS
Thous. Lbs/Sq in.
YIELD STRESS
Thous. Lbs./Sq in.
ELONGATION
% in 2"
RED. IN AREA
%
GREEN
1
2
3
4
5
6
7
8 Hrs.
TIME AT HEAT IN HOURS
6-4-40


PHYSICAL PROPERTIES VS. TIME #2 THERMOCOUPLE IS AT 1300° FAHR.
REGULAR CHARGES IN NEW ANNEALING EQUIPTMENT AT #2 PLANT
MATERIAL:- 30-40 CARBON 13/32" DIA. HOT ROLLED RODS HT 4203
III
ULT. STRESS
Thous. Lbs./Sq in.
YIELD STRESS
Thous. Lbs./Sq in.
ELONGATION
% in 2"
RED. IN AREA
%
GREEN
1
2
3
4
5
6
7
8 Hrs.
TIME AT HEAT IN HOURS
6-13-40


PHYSICAL PROPERTIES VS. TIME #2 THERMOCOUPLE IS AT 1400° F.
REGULAR CHARGES IN NEW ANNEALING EQUIPTMENT
MATERIAL:- 30-40 CARBON 13/32" ϕ RODS HT. No. 4203
V
ULT. STRESS
THOUS. LBS./Sq. In.
YIELD STRESS
THOUS. LBS/Sq. In.
ELONGATION
% IN 2"
RED. IN AREA
%
GREEN
TIME AT HEAT IN HOURS
8 Hrs.
E-30-40 T.E.E.


PHYSICAL PROPERTIES VS. TEMPERATURE WHEN #2 THERMOCOUPLE
HAS BEEN AT HEAT FOR THREE HOURS IN NEW ANNEALING EQUIPTMENT
VI
ULT. STRESS
THOUS. lbs/Sq. IN.
YIELD STRESS
THOUS. lbs/Sq. IN.
ELONGATION
% IN 2"
RED. IN AREA
%
TEMPERATURE
1200° F.
1240°
1280°
1320°
1360°
1400
6-25-40

ever, for the purposes of explanation in this article, the case of #1035 steel only is related.

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TO make the results of any tests truly comparable, all factors entering into the results must be controlled to be as nearly identical as possible. In this case, the factors which had to be controlled were:

1. **Material analysis**
2. **Rod diameter**
3. **Charge weight**
4. **Thermocouple location**
5. **Method of testing**
6. **Method of comparison of data**

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TO take care of the first three points, the cycle tests were run on rods of the same diameter, 11/32", all coils coming from the same open hearth heat number, and the charges were made of the same number of coils to total 4800 lbs.

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THE thermocouple location which was to be used to determine the starting of the soaking time was between the two bottom coils, halfway through the coil. To make sure that this point was located identically for each charge, a special jig was made and placed between the coils as they were loaded on the stripping machine. This jig was, in effect, a short piece of pipe with the hole large enough for the insertion of the thermocouple and with a square flange at the inner end to make sure the jig could not rotate or slip forward or backwards. After the loaded spider was placed on the base, the bottom flexible thermocouple was inserted in the jig. Thus was the temperature point of comparison kept constantly related to the source of heat.

THE testing method decided upon was to determine the following for each charge, taking an average reading from pieces of rod cut from both ends of the top, middle and bottom coils:

1. **Ultimate tensile stress per square inch**
2. **Yield point per square inch**
3. **Reduction in area**
4. **Elongation**

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IN order to determine the proper temperature, it was decided to start running charges to 1200 deg. F. and to progress to 1260 deg. F., 1320 deg. F. and 1400 deg. F. The low limit was known to be too low and the high limit too high but the temperature area was to be explored progressively and by also running the charges at each temperature with soaking times ranging from one to eight hours, the results at each temperature could be adjusted for the most efficient soaking time.

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CHARTS I, III and V are shown to illustrate the results of these tests for 1200 deg. F., 1320 deg. F. and 1400 deg. F. Others were run and the area around 1300 deg. F. was explored by running tests at 10 deg. F. intervals. Of course all charts show a progressive downward ultimate stress as the soaking times increased but a common property of all tests showed that, after three hours of soaking time, there was little decrease in the ultimate, certainly none worth the continuance of the soaking time beyond three hours. So it was decided that for #1035 steel, a three-hour soaking time was to be used.

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WITH this factor standardized the results from tests at all temperatures were tabulated and graphed on Chart VI to show the variation in the physical properties for identical charges, held for the same soaking time but at different temperatures. The first tabulation indicated that the temperature around 1300 to 1350 deg. F. should be more carefully explored and this was done to make the curves continuous and correct, as it was indicated that the proper spheroidizing temperature was to be between these limits.

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AFTER this was done, and the curves completed, the answer was immediately apparent. It was 1330 deg. F. The curves show how the yield and ultimate move downward as the temperatures increase to a certain point, dip sharply at this point and rise again if carried to a temperature which is obviously above the lower critical point.

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ON #1035 steels, this test was repeated on several other rod sizes, which affected the total weight of the charge. The same plan was followed on the other steel analyses. This did not

(*Please turn to Page 471*)

Installation Consisting of Two Lee Wilson Bell Type Units and Five Bases.

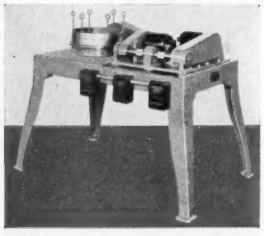
SLEEPER & HARTLEY, Inc.

DESIGNERS AND BUILDERS
of AUTOMATIC WIRE-WORKING MACHINERY
AND WIRE MILL EQUIPMENT

WORCESTER, MASSACHUSETTS, U. S. A.

General Bulletin *(See Note Below)* *June, 1941*

MUSIC WIRE STRAIGHTENING AND BUNDLING

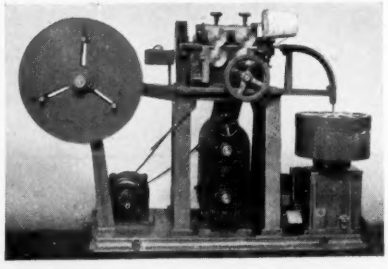


Music Wire should ordinarily be straightened before being put through intermittently operating spring making or wire forming machines. We have several machines for Straightening and Bundling Music Wire.

SPRING SETTING MACHINES

It is customary to "set" many classes of the machinery springs. That is to say, springs are compressed solidly coil to coil so as to prevent shortening in subsequent use. For this operation we offer two sizes of machines, illustrated and described in Bulletin No. 264.

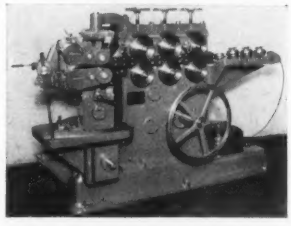
FLEXIBLE TUBE COILING MACHINES



Flexible Metallic Hose and Tubing equipment is described and illustrated in Bulletin No. 309. These machines have a combined range from about 3/16" tubing to 3" tubing. The tubing produced is of the single groove variety.

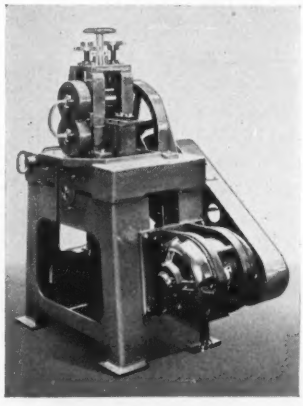
BEARING SPIRAL MACHINES

Designed for high production of bearing spirals from rectangular stock, these machines feature extreme accuracy and simplicity of set-up on either right or left-hand coils, together with ease in varying pitch of helix and entire lack of distortion. This machine reduces finish grinding to a minimum. Made in five sizes. See Bulletin No. 107.

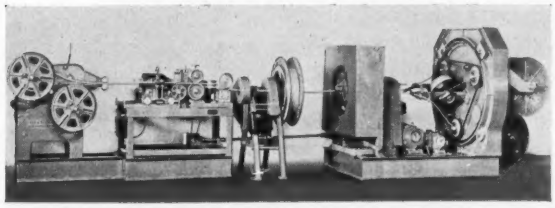


LIGHT ROLLING MILL EQUIPMENT

We offer Rolling Mills for the rolling and flattening of wires in the smaller sizes. This equipment has been especially developed for wire staple and special casing wire forms, and for the rolling of oval galvanized armoring wires. See Bulletin No. 275.



ARMORING EQUIPMENT



The photo shows our Combination Armoring Machine, Series 661 which comprises twisting of wires, paper wrapping, casing forming and wrapping, flexing measuring, automatic cutting, and bundling. Armoring Machines can be supplied for armoring hose wire and cables, including single and twin wires, BX, Parkway Cable, Hose, etc. See Bulletin Nos. 105 and 105-A. Quotations upon request giving your requirements.

Note: This is page 2 of our new 4-page General Bulletin. Your copy is ready.

Rats In The Corn Crib

By Kenneth B. Lewis,
Consulting Wire Mill Engineer,
Worcester, Mass.

A FEW months ago I made calls among a group of half a dozen large wire mills which I had not visited for some time. I was rather amused at the elaborate ceremonies at the gates. I filled out questionnaires, signed books, presented credentials, and when I finally passed into the yard, clanking behind a disc of identity the size of a saucer, a guide took me to the mill office by the outside route, waited, and took me back.

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IT seems that these precautions have been urged upon the mills by the government, with the aim of blocking off saboteurs and subversive activities, but they reminded me of the farmer who was troubled by rats in his corn crib. He finally encased the crib in a wall of concrete that went four feet into the ground. All he overlooked was the fact that when he got through, the rats were all inside.

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WE all have rats in our wire mills, and we not only can't keep them out, but we can't chase them out when we catch them inside. Our government, which knows so well how to annoy salesmen, engineers, and other innocent visitors, is extremely solicitous to protect the rats against the slightest molestation. I would take a contract to put **Adolf Hitler** into any mill in this country, with bombs in his hip pocket and a swastika tattooed on his forehead. First I'd get him a C.I.O. card, then I'd send him right through the employment office. If the manager didn't like his looks I'd get him a lawyer of Asiatic origin and send him to the nearest branch of the **National Labor Relations Board.** Shortly thereafter he'd be in the mill, with an apology and back pay from the day of application.

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DON'T think the courts would give you any support. Does anyone remember that the **Supreme Court** was set up to defend the citizen against the tyranny of his government? Today the nine old men have become the boys in the back room of the New Deal Saloon, and have left us at the mercy of that motley throng of pimps, bootleggers, ex-convicts and miscellaneous thugs who have muscled in on the richest racket the world has ever known. They have plenary indulgence to manipulate the N.L.R.B., and in general to administer that running sore in the side of Industry, the Wagner Act.

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JUDGE HAROLD STEPHENS recently did an unusual and courageous piece of research—that is, unusual for a New Deal appointee. He read, word for word, the stenographic record of a case settled by the **N.L.R.B.,** and then took 50,000 words to summarize its errors and abuses of power. The board, in **Judge Stephens'** words **"condemns friendly co-operation, normal relations, and innocent communications between an employer and employes,"** and **denies to employers "that freedom of expression concerning the merits of labor disputes and organizations which has been recognized by the Supreme Court as guaranteed to employers."**

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LABOR leaders today know that they have the labor board and its examiners securely attached as partisans to their cause, and that the courts, under New Deal domination, will uphold arbitrary actions, so there is an open invitation to the exploitation of workers by their officers. The democratic principle supposedly espoused in the **Wagner Act** is viciously disregarded.

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REGARDING the **Bethlehem E. R. P., Judge Stephens** declares that the record discloses absolutely no evidence of dissatisfaction by the workers, and no election by them to determine whether they desired to perpetuate or discontinue that plan. Their organization was simply destroyed by arbitrary decree. Says the Judge, **"I think the order of the board accomplishes injustice both for the petitioners as employers and for the employes themselves, and that it should be set aside."**

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WONDERING whether wire mill executives as a whole were fully alive to the situation, and had any thoughts worth recording, I sought an interview with that well-known industrialist, **Mr. J. J. Whoosis,** whose reactions so perfectly mirrored the collective mind of the wire industry that he was chosen **"Mr. America"** at the Cleveland Convention. **"Mr. Whoosis,"** I asked, "how are your relations with your men?"

Answer: Strictly formal. When I walk through the mill I don't dare say 'Good morning, Mike" for fear I'll be had up for trying to influence Mike in his choice of a bargaining agency.

Q. Do you mean to say you can't talk with your men?

A. Talk with them? My dear fellow, I can't even approach them, to the satisfaction of the N.L.R.B. except in an attitude that would spell halitosis. I won't stoop so low. My boys as individuals are the same good fellows they always were, but collectively they are sullen, suspicious, resentful, and bewildered. They feel that

they are being pushed around, and they don't see just where the thing is going to end. Luckily they are beginning to realize that I'm not doing the pushing. We had a little rumpus here recently about the **Walsh-Healey** Act. You know we have quite a few 24-hour operations here, patenting, galvanizing, annealing, and the like. To keep down to 42 hours we have had to put on four shifts.

Q. Pardon me for interrupting, **Mr. Whoosis,** but do you like the 42 hour week?

A. Oh well, I don't blame the boys much for reaching out for all they can get; I suppose these modern pansies need lots of rest, but I smile a little when I recall that at their age my week was 84 hours, just double theirs. Of course I realize that it was a man-killer. Look what it did to me—I can't get under 80 to save my soul, and after 18 holes I don't dare start another 18 without taking a little stimulant.

Well, as I was saying, I talked it over with the boys, it was their idea, and we arranged for each shift, three 12-hour days and 6 hours on Sunday. A man worked, for instance, six hours Sunday, then 12-hour shifts Monday, Tuesday and Wednesday, and then he had three days entirely free. The married men, quite a few of them, bought farms out in the country, and the younger fellows built fishing and shooting shacks, bought motor boats, and got all set for year-'round vacations. Then an inspector popped up and proved that some of our rope orders had Naval implications and that under the **Walsh-Healey** Act no man could work more than eight hours in one day.

The boys were wild. I had a hell of a time before I made it clear to them that it was their **Uncle Sam** that had broken up their homes. Now they're more thoughtful about labor laws. Nobody seems to know anything about **Healey,** but **Walsh,** with that beautiful ivory dome, is a marked man. If he ever comes out our way he'd better wear iron pants.

✦ ✦ ✦

Q. **Mr. Whoosis,** I read you my little article about rats in the corn crib. Do I gather that you agree with me?

A. Yes, as far as you go, but why confine your comments to the little rats in the mills and ignore the big rats sitting behind the mahogany desks in Washington?

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Q. I thought such comment would show a lack of respect for our **Great Leader.**

A. Respect? Good God, if the time ever comes when I can't tick off the hired man I'll move to England where you can still call a spade a spade or even a steam-shovel if you feel so inclined. Free speech is one of the last vestiges of our liberties, so why not use it?

✦ ✦ ✦

Q. Your feeling is, I take it, that the **President** is badly advised?

A. That's a lot of malarkey, and you know it. The **President** picks out his own advisors, and if they don't give him the advice he wants to hear, he throws them back on the wood-pile and whittles out some more. Look at the Florida ship canal. One advisory board after another turned it down, and was discharged. Finally he got an anonymous board of **"Army Engineers"** to endorse it. Well, maybe they didn't need their jobs and promotions! Look at the asinine scheme of increasing steel production. He hired **Gano Dunn** to report on that, and couldn't have got a better man. **Dunn** turned it down. Then some eagle-beak on the literary staff wrote a report ridiculing **Dunn's** report. **Dunn** wrote a rebuttal which made eagle-beak look like a monkey, and then found that his personal affairs needed all his attention, and resigned.

So now we're going to increase steel production. Even the **O.P.M.** has had to reverse itself on that. Somebody asked **Bill Knudsen** why he changed his mind, and Bill said innocently "Ve got a letter from de President." Poor Bill, torn between his innate common sense and his conception of loyalty to his adopted country! I imagine this is not the first time he's had to swallow his convictions.

What **Roosevelt** really wants, I think, is not so much an increase in available steel as a chance to get his hands on a few steel plants for Government operation. Yardsticks, you know. He hates the steel industry anyway. It's too big, too powerful, too wealthy, too intelligent, and not subservient enough.

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Q. Don't you think that possibly the President, in this matter of steel, has sources of information superior to ours?

A. Information Hell! He doesn't use information, he works on hunches. "A steel industry on the Pacific Coast," he said recently, "has always been a hobby of mine." Happy man, he can pursue hobbies at other folks' expense. Another hobby, I suppose, would be the development of steel manufacture without coking coal. A President who has never had to consider the cost of anything whatever doesn't inspire confidence as manager of a steel industry.

And, mind you, this is the man who said a few years ago, "Our industrial plant is built; in fact, it is probable that it is overbuilt. From now on our problem is not production but distribution."

Mr. Roosevelt's stubbornness in this steel situation is only what could have been expected by one who followed his train of reasoning in hydro-electric matters.

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Q. Why **Mr. Whoosis,** don't you agree with the **President** that we should harness the free energy which bountiful Nature has given us in the form of falling water?

A. I see that you and **Roosevelt** share the general misconception about hydro. There is a Persian proverb that runs "God gives each bird its food, but he doesn't throw it into the nest." So it is with falling water. It is frightfully costly to harness it; so costly, indeed, that a hydro-electric plant is an awful temptation to free spenders of other people's money. The fact is there are mighty few situations where steam generated power can't compete, and doesn't compete, with God's free gift. Even on the Niagara River you'll find a flourishing steam plant.

You see, to get an installation

cost within reason you need a considerable drop within a short span of the stream. With a few exceptions this is a combination found only in terrain so broken that it takes three locomotives to pull one box car. In such terrain there is no agriculture, no population, no market, and as a rule no raw material. Population and industries will sheer away from such parts unless heavily subsidized, or unless, as with aluminum, abundant electric energy is the heaviest item in their cost. Hydro enthusiasts are always taunting us with the beautiful installations in such poor countries as Italy and Switzerland. Well, maybe that's why they're poor. They lack coal, and have to do the next best thing.

Another thing too little emphasized is that water turbines now convert 95% of the energy of falling water into power. Steam plants, on the other hand, although they have crept up constantly in efficiency during our lifetime, are still, I believe, on the low side of 50. In other words, as time goes on, the relative cost of hydro as compared to steam power, will go still higher. And another little item: Do you know that of the total cost of electric energy delivered to the customer, 85% comes after the current leaves the power-house? It goes for transmission, distribution, accounting, service, billing, meter reading, bad debts, taxes, and the like. Even if hydro-electric power was, in fact as well as in fiction, free, and even if the New Deal auditors allocated 100 instead of 80 per cent of the cost to improving navigation in Rattlesnake Canyon, controlling floods at Sandy Butte, and irrigating the truck gardens of government employees, I venture to say that private interests would beat hell out of the hydro project on a cost basis. And don't forget, the one pays taxes, the other eats taxes.

I have heard extreme conservationists get sentimental over our coal supply, the extraction of which they seem to think implies cruelty. It ought to be left in the ground for posterity. Well, we've got about 1200 years supply in sight, and what's the matter with keeping our hydro sites for posterity and using up the nasty coal ourselves. It's a pretty good rule of economy to use the cheapest stuff first. Maybe by the year 3000 A.D. our successors will have learned how to set a freight car on top of the Rocky Mountains without charge.

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Q. Don't you think it would be well to have an ample supply of electric energy available for our heavy industries, especially in times like these?

A. It's very easy to exaggerate the role of power in the war industries. I was connected at one time with a concern that built equipment for the steel industry. We grossed three to five million dollars a year. Our installed power was, as I recall, 150 H.P., of which we seldom used over 50. Take our own industry, wire; something under 15% of our cost is power. Of course, I make an exception of aluminum; there's a metal that really lives on electric power.

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Q. That brings up a matter I intended to ask you about, **Mr. Whoosis.** What do you think of the aluminum situation?

A. What **Is** the Aluminum situation? Who knows? All our information comes from a group of congenital liars who have always been intensely interested in building up a case against the **Aluminum Company of America.** I'm not sure there is a shortage, but if there is, I know whose fault it is. **Roosevelt** has assigned his number one hatchet man to the task of discrediting the **ALCOA** so we can be sure the heat is being turned on for a sinister purpose.

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Q. Why should the New Deal want to discredit **ALCOA?**

A. Well, it's a **Mellon** industry; that's reason enough. They hate the memory of **Andrew Mellon.** He was wealthy, he was efficient, he was powerful, he was successful. He was a great Republican, he was a great Secretary of the Treasury, so great that these nitwits not only can't imitate him, they can't even understand him. Every time they sued him for evading income tax he proved that they really owed him a rebate, and he collected it. As a crowning injury, he gave so much of his estate to the government that not only were they unable to beggar his heirs with inheritance taxes, but they were forced to make public acknowledgement of his bounty. They hate his guts.

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Q. Just how did **Mellon** hook in with aluminum?

A. As I recall it, he was the first to suspect that this curious metal had commercial possibilities. He took the inventors out of their garret, set them up with equipment, and put behind them his influence, his great fund of common sense, his driving force, his organizing genius, and his dollars. Do you remember when the only piece of aluminum in the house was a little souvenir pin-tray, beautifully stencilled "In memory of a happy summer at Old Orchard Beach" or "Souvenir of the Columbian Exposition, 1893." Any housewife over the age of 50 remembers how she got her first aluminum kitchen-ware. It was practically shoved down her throat by a house-to-house canvasser with one foot in the screen door, and instructions to get a dish into every house regardless of cost. **Mellon,** always planning in decades, saw that he must have volume in order to cut costs, so as to get wider markets, so as to cut costs again, and so on; the cycle so familiar to industry, and so incomprehensible to the New Deal. **Little Scorpion Ickes** charges **Alcoa** with holding down production and keeping up prices. He proves himself an ass in the eyes of every business man in the country. That sort of procedure, common in government circles in such commodities as wheat, cotton, hogs, etc., just doesn't happen in the business world. Mellon strained every nerve to build up volume. He never waited for demand; he created supply and then went out and forced demand. The airplane industry wouldn't even know how to spell aluminum if it had not been for **Alcoa.** I recall when he started rolling structural shapes,

(*Please turn to Page 458*)

Important Properties of Electrical Insulating Papers

By Dr. H. H. Race, R. J. Hemphill, and H. S. Endicott,
Research Laboratory and Pittsfield Works Laboratory,
General Electric Company

Types of paper and applications—Thickness—Density—Finish—Strength—Porosity—Chemical characteristics—Conducting particles—Power factor.

LOW cost, good electrical and mechanical properties, and the availability and controllability of wide ranges of physical characteristics are the major reasons for the many uses of paper in the electrical industry. An idea of its importance may be gained from the fact that one manufacturing company alone will purchase approximately $2,000,000 worth of insulating papers during the present year.

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THE quality of insulating paper is extremely important because improvements in quality result in corresponding decreases in the quantity required for a given application. Furthermore, in many types of apparatus, savings in space occupied by insulating paper make possible further savings in size, weight, and cost. For example, in a typical piece of electrical apparatus, although the cost of the insulation and its fabrication represents only 13 per cent of the total cost, a decrease of 10 per cent of the required volume of the insulation may result in a smaller unit of the same rating with a disproportionately larger saving in total cost. The possibility of such a saving provides one of the incentives for continued attempts at quality improvement of insulating paper.

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THE object of this article is to present information about the types of paper commonly used in electrical apparatus, to indicate the testing methods used to evaluate and control their quality, and to give typical data concerning some of their electrical properties. Furthermore, it is extremely important to point out that the desired electrical properties are directly dependent upon the physical and chemical properties incorporated in the paper by the maker.

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TABLE I: RANGES OF PROPERTIES OF INSULATING PAPERS

	Raw Material	Type Machine	Thickness Range (inches)	Apparent Density (gm/cc)	Finish	Tensile Strength (lb. per. sq. in. $\times 10^{-3}$)	
						M.D.*	C.M.D.**
Dielectric Capacitor Paper	100% Kraft	F*	0.0003—0.001	0.90—1.1	SC†	.....	.....
	100% Linen	F	0.0003—0.001	0.9—1.1	SC†	.....	.....
Electrolytic Capacitor Paper	Misc.	F	0.001—0.003	0.45—0.55	MC†	.....	.....
Cable Paper	100% Kraft	C* & F	0.003—0.010	0.7—1.1	MC & SC	8—16	4—6
	Manila	C & F	0.001—0.010	0.7—0.75	MC	10—16	3—5
Coil Winding Paper	Miscellaneous	F	0.0007—0.005	0.8—1.1	MC	.....	.....
Saturating Papers	100% Kraft	F	0.0015—0.035	0.5—0.9	MC	4—8	2—3
	Alpha	F	0.003—0.015	0.5—0.9	MC	0.2—1 (5)	0.1—0.5
Layer Insulation	100% Kraft	C	0.005—0.030	0.7—1.0	MC, SC, WF†	8—16	5—7
	100% Kraft	F	0.001—0.015	0.8—.85	MC, SC, WF†	6—10	4—5
Pressboards	100% Rag	W*	0.005—0.025	≥1.2	GR†	11—12	4—5
	75% Rag 25% Kraft	W	0.030—0.250	1—1.2	SC	.....	.....
	100% Kraft	W	0.030—0.125	1—1.2	SC	10—12	4—5

*F: Fourdrinier machine
*C: Cylinder machine
*W: Wet machine

† SC: Supercalendered
†MC: Machine calendered
†WF: Water finished
†GR: Glaze rolled

*MD: Measurement of tensile strength in direction of formation of sheet

**CMD: Measurement of tensile strength at right angles to direction of formation of sheet

Types of Paper and Their Properties

IN Table I are listed a number of types of paper commonly used in the electrical industry. Where available, the more important physical, chemical, and electrical properties of the several types are given.

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Raw Materials and Paper-making Machines

RAW MATERIALS. The great bulk of insulating paper is made from kraft pulp, linen rags, cotton rags, and Manila hemp. Methods are available for identification of fibers[1] showing differences in the structure of fibers derived from these several sources. Each of these materials has properties which make it especially desirable for specific applications, some of which will be shown later.

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TYPES OF PAPER-MAKING MACHINES.[2] Because of the wide differences in the physical properties required in electrical insulating papers, they are made on all three common types of paper-making machines and their modifications. In Table I, these are designated as (F) Fourdrinier, (C) cylinder, and (W) wet machines.

Test Methods and Their Significance

Physical Properties

THICKNESS. Under this heading are given common ranges in which paper is made for different applications. The thicknesses given are nominal values measured by means of a machinist micrometer, ASTM D374 method A, or dial gage according to TAPPI method T411. Normally ±10 per cent tolerance in thickness is allowable.

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APPARENT DENSITY. ASTM D202-39T. Experience has shown that the electrical properties — that is, dielectric strength, dielectric loss, and dielectric constant—depend upon the apparent density so that this property must be closely controlled about the value found most desirable for a specific application. In the table are given nominal density ranges.

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FINISH. The finishing operation is very important in determining the physical properties such as density, smoothness, and mechanical strength. The common finishes are machine calendered (MC), supercalendered (SC), water finished (WF), and glaze rolled (GR).

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TENSILE STRENGTH. ASTM D202-39T and TAPPI T404. This is normally measured both in the direction of formation of the sheet (MD) and at right angles to it (CMD). It is of particular importance in papers applied in the form of tape where tension is used to obtain a tight structure.

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TEARING STRENGTH. ASTM D202-39T and TAPPI T414. One of the important uses for insulating papers is spiral wrapping in tape form on electrical conductors. In such operations the paper is subjected to crosswise tearing stresses as well as simple tension.

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POROSITY (Air Resistance). The method in general use for indicating the porosity of paper is to measure the rate of flow of air through the sheet under a specified pressure difference (ASTM D202-39T and GE method E1B8). The latter method has been developed for testing low-porosity paper. Porosity is an indication of the structure of the sheet and is of importance in determining the

(1) John N. Graff: Color Atlas for Fiber Identification (1940).

(2) Manufacture of Pulp and Paper, vol. 5, McGraw-Hill Book Co., 1939.

TABLE I: RANGES OF PROPERTIES OF INSULATING PAPERS (Cont'd)

Tearing Strength (gms per mil thick)		Porosity (air resistance) sec	Ash Content (per cent)	Chlorides	Sulphates	Conducting Particles		Power Factor Dry 60 Cycle 60° C
MD	CMD					No. per sq. ft.	Volts per Mil	
.....	.....	≥250	<0.5	NDA†	NDA	≤10	110	≤0.002
.....	.....	≥250	<0.5	NDA	NDA	≤10	110	≤0.002
.....	.....	<1	<0.3	NDA	NDA	≤5	110	....
20—40	40—60	8—500(1)	0.3—0.4	NDA	NDA	....	...	≤0.002
35—70	45—70	3—20(1)	2.5	NDA	NDA	....	...	....
.....	.....	.....	≤0.5	NDA	NDA	....	...	....
.....	.....	5—20 (2)	1	....	....	....	...	....
.....	.....	5—50(2)	1	....	....	....	...	....
35—50	40—55	.....	≤1	....	....	<0.07	100	....
10—15	10—15	.....	≤1	....	....	<0.07	100	....
40—60	60—90	.....	≤1	....	....	≤0.01	150	....
.....	.....	.....	≤4	....	....	≤0.01	100	....
.....	.....	.....	≤1	....	....	≤0.01	100	....

(1) Sec per mil per 100 cc
(2) Gurley densometer (400 cc)
(3) Measured after soaking in varnish

†NDA: No detectable amount

suitability of the paper for use where impregnation with oils, resins, varnishes, etc., is involved.

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Chemical Properties

ASH CONTENT. TAPPI T413. A low ash content is an indication of freedom from clay, fillers, pigments and other inorganic contaminants, the presence of which might lead to poor electrical properties.

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ACIDITY. ASTM D202-39T and TAPPI T413. From the standpoint of chemical and electrical stability over a period of years during operation at elevated temperatures, neutral papers have proved most satisfactory. The present methods for measuring this property are not altogether satisfactory and a new method, proposed by Launer,[3] is being investigated by ASTM and TAPPI.

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CHLORIDES AND SULPHATES. From the standpoint of electrical properties it is necessary to keep electrolytic contamination to a minimum. A special control method for establishing an upper limit for such contamination has been developed. A 10-gm cut sample of paper is boiled for 15 min. in 250 cc of distilled water. Further important details are as follows:

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TEST FOR CHLORIDES. Three test tubes are prepared, into the first of which is decanted 10 cc of the **hot** extract. This is acidified with two drops of concentrated HNO_3 and 2 cc of 10 per cent solution of silver nitrate added. 10 cc of the **hot** extract are decanted into the second tube and acidified with 2 drops of concentrated HNO_3. 10 cc of hot distilled water which has been boiled 15 min. is placed in the third tube, acidified with 2 drops of concentrated HNO_3 and 2 cc of 10 per cent solution of silver nitrate added. The three tubes are allowed to stand for 30 min. and then examined for turbidity in a strong light against a dark background. Tube No. 1 (paper extract, silver nitrate and nitric acid) should show no more turbidity than tube No. 2 (paper extract and nitric acid). Tube No. 3 (distilled water, silver nitrate and nitric acid) must show no turbidity.

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TEST FOR SULPHATES. Three test tubes are prepared, into the first of which is decanted 10 cc of **hot** paper extract. This is acidified with 3 drops of (1:1) HCl and 2 cc of 10 per cent barium chloride solution added. 10 cc of the **hot** extract are decanted into the second tube and acidified with 3 drops of (1:1) HCl. 10 cc of hot distilled water which has been boiled 15 min. is placed in the third tube, acidified with 3 drops of (1:1) HCl and 2 cc of 10 per cent solution of barium chloride added. The three tubes are allowed to stand for 30 min. and then examined for turbidity in a strong light against a dark background. Tube No. 1 (paper extract, HCl and $BaCl_2$) should show no more turbidity than tube No. 2 (paper extract and HCl). Tube No. 3 (distilled water, HCl and $BaCl_2$) must show no turbidity.

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IT is estimated roughly that NDA (no detectable amount) corresponds to approximately 6 ppm of chlorides and 60 ppm of sulphates in the dry paper.

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CONDUCTING PARTICLES. (Survey for Conducting Paths) ASTM D202-39T. It is common practice for users of sheet insulation to control quality by measuring the number of conducting particles or spots of low dielectric strength. The method usually employed for layer insulation is to pass the sheet between a metal plate and a set of rollers. Voltage is applied between the rollers and the plate and, as the paper is drawn through, an operator marks the spots at which failures occur. The spots are subsequently cut out. In the case of thin papers for use in capacitors or cables, samples only are tested. Single sheets are laid on a metal plate and a metal roller is run over them by hand. Headphones are connected in series with the voltage supply and the electrodes, and the operator counts the clicks as the conducting spots are found. A device for testing continuous lengths of this paper is pictured by J. M. Finch.[4] In Table I are given the maximum tolerable number per unit area and the gradient at which the test is made. Considerable effort, over a period of years, has been expended to get the number of conducting particles as low as indicated. Nevertheless, it would be a real advantage to the electrical industry if their number could be still further reduced.

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Electrical Properties

POWER FACTOR—DRY. This test is applied wherever the dielectric losses of the finished part are of primary importance. It is probably the most rigid test made on capacitor paper, and, since it is relatively new, details and typical data are included in the next section.

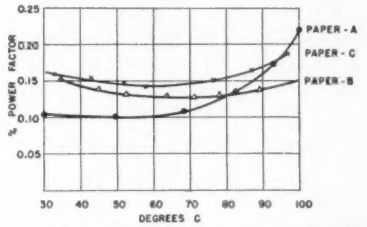

Fig. 1. Curves for dry capacitor paper plotted as power factor versus temperature.

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Types of Paper and Their Particular Requirements

DIELECTRIC CAPACITOR PAPER. In capacitors, very thin dielectrics are required in order to obtain high capacitance per unit area. Furthermore, to prevent electrical failure resulting from a single conducting particle or weak spot in one sheet, it is necessary to use two or more sheets in series. In this way the probability of failure from such imperfections is greatly reduced. Thus, instead of using a single sheet of 0.0009-in. paper, three sheets of 0.0003-in. paper are commonly used. For such use papers were originally made from linen fiber but are now made largely from all-kraft pulp. Small amounts

(3) H. F. Launer: Journal of Research of the Nat'l Bureau of Standards, 23, 663 (1939) Research Paper RP1262.

(4) J. M. Finch: "Insulating Papers in the Telephone Industry," J. Ind. and Eng. Chem., vol. 32, no. 8, p. 1021.

are made, particularly in European countries, from sulphite pulp, but the use of the latter has been very much restricted owing to the instability of the electrical and physical characteristics.

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CAPACITOR papers are manufactured from well-washed and well-beaten pulp. The beating cycle in some cases may be as long as 48 hr. in order to bring about the high degree of hydration and fibrillation necessary for the fabrication of a thin, well-formed sheet.

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THE paper is made on a Fourdrinier machine, sometimes with an Edwards' attachment, but in greater amounts on a Fourdrinier machine of the Harper type. Some kind of centrifugal separator is always used on the stock before it goes to the machine to remove metallic and other conducting particles of high density. The sheet is supercalendered to produce a high finish, improve the uniformity of thickness, and increase the density.

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THESE papers are characterized by good formation, high air resistance, relative freedom from metallic and conducting particles, freedom from other impurities, and uniformity of thickness.

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ONE of the most important properties of this type of paper is its dielectric loss because losses represent energy wasted as heat, and heat-dissipating ability is one of the limitations of electrical apparatus. For low-loss materials, the heat generated per unit volume[5] is proportional to the square of the voltage gradient $(E/l)^2$, the dielectric constant ε', and the power factor PF. Since economic considerations demand a high voltage gradient and a high dielectric constant, power factor is the only term which is subject to reduction.

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THE power factor of a composite dielectric consisting of impregnating liquid and paper is a function of the power factors and the dielectric constants of the two components; but, in general, it is not possible to calculate exactly the power factor of such a combination from measurements on the separate components. However, power-factor measurements on paper alone have been used for years to detect and reject lots of paper which showed high losses. Recently such methods have been considerably refined and a direct correlation has been found between the 60-cycle power factor as a function of temperature of the paper alone and of the finished capacitor.

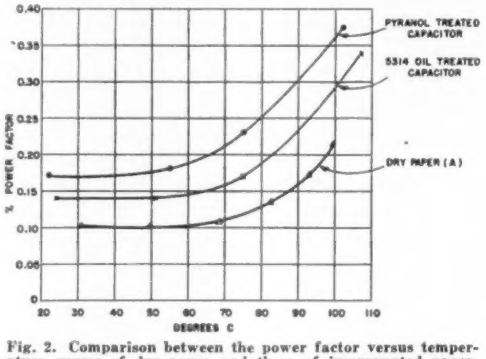

Fig. 2. Comparison between the power factor versus temperature curves of dry paper and those of impregnated paper.

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FLAT-disk guarded electrodes have been used with the paper under a stress of 125 volts per mil. In making such measurements it is essential that the paper be thoroughly dried and maintained in that condition throughout the test. To assure this, the electrodes, with the paper in place, are mounted in a desiccator and dried for 16 hrs. at 100 C at a pressure of 10^{-3} mm. At the end of the drying period, thoroughly dried air is admitted and the electrical measurements made at intervals as the temperature drops.

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FIG. 1 shows typical curves for capacitor papers. These curves demonstrate the fact that it is possible to change the value of the power factor as well as the shape of the power-factor—temperature curve of paper sheets by changing the nature of the pulp.

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FIG. 2 gives a comparison between the power factor—temperature curves of dry paper *A* and those of the oil treated or Pyranol treated paper.

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IT is possible to explain these data if the paper and impregnant are assumed to form a two-layer series dielectric.[6]

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FOR this condition the following relations apply:

$$\varepsilon' = \frac{\varepsilon_f' \, \varepsilon_i'}{\theta'_f \, \varepsilon_i' + \theta_i \, \varepsilon_f'} \qquad (1)$$

where ε' = dielectric constant of the combination
ε_f' = dielectric constant of the paper fibers
ε_i' = dielectric constant of the impregnant
θ_f = fractional volume represented by paper fibers
θ_i = fractional volume represented by impregnant

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IN low-loss materials, for which the cosine and cotangent of the loss angle are approximately equal

$$\mathrm{PF} = \frac{\theta_f \, \varepsilon_i' \, (\mathrm{PF}_f) + \theta_i \, \varepsilon_f' \, (\mathrm{PF}_i)}{\theta_f \, \varepsilon_i' + \theta_i \, \varepsilon_f'} \qquad (2)$$

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FIG. 3 shows the power-factor—temperature relation for a low-viscosity cable oil (GE No. 5314) and GE No. 1476 Pyranol. At 60 cycles per second over the temperature range shown, the power factor is due to conduction. The change in conductivity with temperature results from changes in viscosity as indicated by the reciprocal viscosity — temperature curves shown dashed in Fig. 3. It is evident that the power factor of the liquid as given in Fig. 3 combined with the power factor of the paper in Fig. 1 will not give the curves of Fig. 2 for the impregnated capacitor.

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IT seems reasonable to assume, therefore, that the paper fibers of the dense, highly air-resistant sheets used for capacitors prevent

[5] H. H. Race, Elec. Eng. 55, 1347 (Appendix) Dec. 1936.

[6] A. Buchner: Wissenschaftliche Veroffentlichungen aus der Siemens-Werken, 18, 204, Feb. 1939.

most of the ionic conduction. The conductance of the liquid, unless of a much higher order of magnitude, will thus contribute nothing to the power factor of the impregnated capacitor.

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BY taking the ratio between Equation (1) when $\varepsilon_i' = 1$ (air) and when $\varepsilon_i' = \varepsilon_o'$ (liquid impregnant) the increase in capacity due to impregnation can be calculated. Similarly, from Equation (2) (assuming that $PF_i = 0$ on the basis of the preceding paragraph) the increase in power factor due to impregnation can be calculated.

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ON this basis the two ratios are identical and are

$$\text{ratio } \frac{\text{impregnated}}{\text{unimpregnated}} = \varepsilon_i' \frac{\theta_f + \theta_i \varepsilon_f'}{\theta_f \varepsilon_i' + \theta_i \varepsilon_f'} \qquad (3)$$

✦ ✦ ✦

IT can be shown by the use of the foregoing equations that the increase of power factor of impregnated specimens over that of dry paper alone can be accounted for by the change in the capacitance of the specimen with the assumption that the losses in the impregnant are negligible.

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THE conclusions to which this leads are:

(1). The dielectric losses depend upon the dielectric loss in the paper and the relative dielectric constants of liquid and paper, and not on the power factor of the liquid, and

(2). The greatest possibility for a reduction in dielectric loss over the usual temperature and frequency range lies in improving the electrical properties of the paper.

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ELECTROLYTIC CAPACITOR PAPER. Very porous, absorbent, low-density sheets having a thickness from 0.001 in. to 0.003 in. are used in electrolytic capacitors. In this type of application the paper serves mainly as a spacer between the electrodes and as an absorbent medium for the electrolyte. This paper is made on a Fourdrinier machine from long-fibered stock having very little hydration. The fibers used are generally of the Manila famliy such as abaca, but a number of other pulps such as kraft, kraft mixed with other wood fibers, and rag have been utilized. Bleached fibers are not used owing to the impracticability of washing them free from chlorides which are extremely objectionable because of the resulting short life of the capacitors.

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CABLE PAPER. Large quantities of paper are used for the insulation of high-voltage cables, low-voltage cables, and the round and rectangular conductors for a large variety of applications in many forms of electrical equipment such as transformers, coils, voltage regulators, magnets, rotating machinery, etc. All such papers are usually classified as cable papers. They are usually applied spirally on wire-covering machines from pads or cops in the form of narrow strips, from a width of 1/64 in. in the thinner tapes to a width of three or four inches in the thicker ones. The covering is done at relatively high speeds and with considerable tension. In order that the paper withstand this operation, as well as subsequent bending of cables and conductors, without tearing, it is essential that the tapes have high tensile strength and stretch in the machine direction, and high crosswise tearing strength.

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TO obtain the highest values for the foregoing mechanical characteristics, cable papers have been manufactured in large amounts from Manila hemp on cylinder machines. The source of the fiber is largely old rope which is prepared for paper making by cutting, dusting, and mild alkaline digestion. Sometimes a small percentage of new hemp is added.

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DURING recent years a number of factors have contributed to changes in the methods of manufacture and the raw materials used for cable papers. In high-voltage power cables the paper insulation must be built up to thicknesses as great as one inch in some cases.

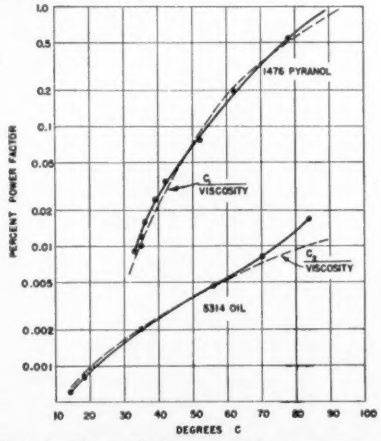

Fig. 3. Power factor versus temperature and reciprocal viscosity versus temperature curves for G.E. No. 5314 oil and G.E. No. 1476 Pyranol.

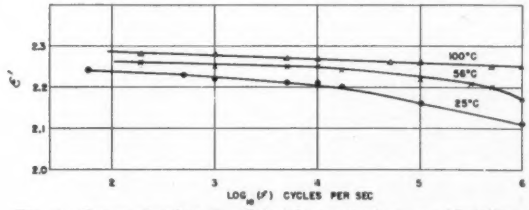

Fig. 4. Curves showing the dielectric constant E′ as a function of frequency for dry cable paper.

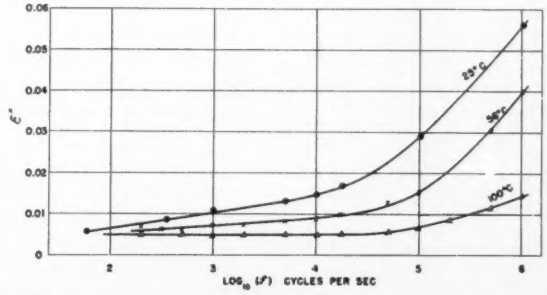

Fig. 5. Dielectric loss factor E″ as a function of frequency for dry cable paper.

In order to obtain uniformity and to be able to wind the inner layers under maximum tension, the stock is stored and the entire winding operation is performed in a controlled-humidity atmosphere. Kraft pulps have also been improved, particularly in the "light strong," and semibleached varieties, so that satisfactory sheets are made from kraft and Manila hemp combinations and from kraft alone. For some applications, these pulps may be used to produce thicker cable papers on a Fourdrinier machine.

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IN addition to the foregoing mechanical characteristics, a number of other requirements must be met in cable papers. When they are used to cover high-voltage cables, a great many layers are applied in order to build up the required dielectric strength. Dielectric losses and consequent heating effects become of importance and, as has been shown for capacitor papers, considerable work has been done in an attempt to understand the electrical properties of the composite dielectric made up of liquid-impregnated paper.

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Dielectric Constant and Dielectric Loss of Oil-impregnated Paper

THE dielectric constant (ε') of low-viscosity mineral oil is roughly 2.2. The dielectric constant of pure cellulose is 6.1[7] The dielectric constant of paper fibers is about 5.5.[6] In oil-impregnated paper, if the electrical properties of the two materials were additive, the apparent dielectric constant of the composite would be expected to be between 2.2 and 5.5 in proportion to their volumetric ratio. This is an over-simplification,[8] however, since cable paper forms a porous matrix with oil filling the interstices in the paper sheets and the spaces between sheets so that the paper fibers and the oil-filled spaces constitute an unknown arrangement of series and parallel elements having different electrical properties. Also little is known about the effects of adsorption and interfacial forces on the composite electrical properties.[9][10] If the paper is in the form of dense sheets, the assumption that the paper is in series with the oil spaces most nearly fits experimental data.[6] In general, our hope is to understand the mechanisms of capacitance and loss sufficiently well to be able to calculate quantitatively the properties of specific combinations from known characteristics of the constituents.

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FOR example, a low-viscosity commercial mineral cable oil (G.E. No. 5314) has a dielectric constant which is independent of frequency between 60 and 10^6 cycles per second and varies with temperature between 0 and 100 C inversely as the change in density. Furthermore, the dielectric loss in the liquid is very low if it is free from soluble contaminants and water. ($\varepsilon'' = 0.0002$ throughout the temperature and frequency ranges indicated.)

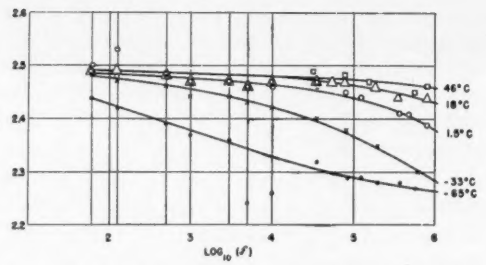

Fig. 7. Curves for cable paper impregnated with No. 5314 oil showing effective dielectric constant E′ as a function of frequency f for different temperatures. ✦ ✦

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THE dielectric constant and loss factor for dry cable paper are shown in Figs. 4 and 5. These data were all taken using a guarded specimen.[11] Before making the 100 C measurements the paper had been kept at 105 C for 18 hrs. in the test cell which was mounted in a closed cabinet in which was maintained a positive pressure of pre-dried air. After the 100 C measurements were completed the temperature was lowered for the 55 C and then the 25 C measurements without opening the cabinet. Then the source of dry air was stopped and a sulphuric-acid and water mixture adjusted to give 60 per cent relative humidity was placed in a tray in the bottom of the cabinet. The paper was allow-

(7) H. A. DeLuca, W. B. Campbell, and O. Maass: Can. Jr. of Res. 16, 273, Aug. 1938.

(8) J. B. Whitehead; AIEE Preprint No. 39-111.

(9) H. H. Race: Elec. Eng. 52, 52, Jan. 1933.

(10) G. T. Kohman: Ind. & Eng. Chem. 31, 807 (1939).

(11) S. I. Reynolds and H. H. Race: General Electric Review 41, 529, Dec. 1938.

(12) E. J. Murphy and S. O. Morgan: Bell. Syst. Tech. Jr., 17, 640, Oct. (1938).

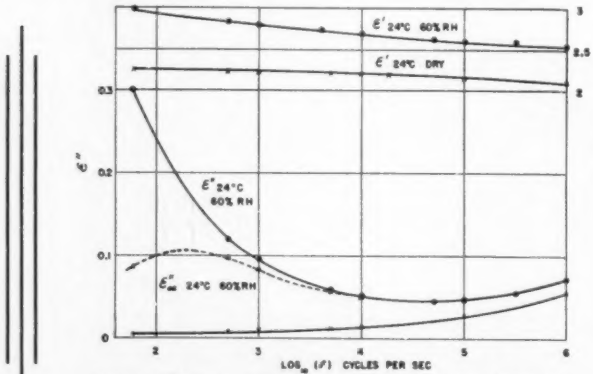

Fig. 6. Dielectric constant E′ and dielectric loss factor E″ dry and after reaching equilibrium at 60 per cent relative humidity for cable paper. ✦ ✦ ✦

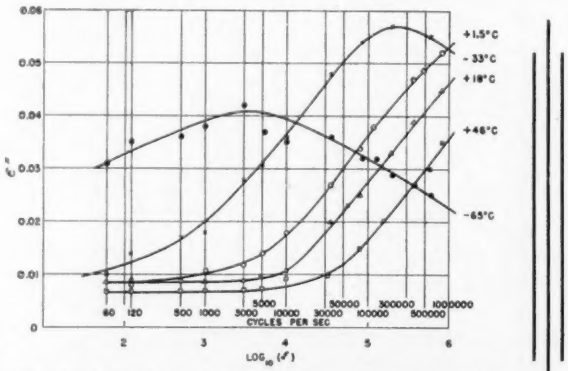

Fig. 8. Curves for cable paper impregnated with No. 5314 oil showing loss factor as a function of frequency for different temperatures. ✦ ✦ ✦ ✦

ed 18 hrs. to reach equilibrium, and remeasured with the results shown in Fig. 6.

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IN Figs. 7 and 8 are shown the dielectric-constant and loss-factor data obtained some time ago on a sample of similar paper dried and impregnated with a similar oil. The cylindrical guarded cell used for these measurements is shown in Fig. 9.

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IT is interesting to speculate on the mechanisms responsible for the foregoing observed characteristics. Referring first to Fig. 6 the effect of the re-adsorbed moisture was to increase the apparent dielectric constant throughout the entire frequency range and also to increase the loss factor, particularly at low frequency. Previous investigations,[9][12] have shown that an electrical relaxation mechanism is indicated when dielectric constant and loss factor data are obtained, similar in whole or in part to the general curves shown in Fig. 10. On the other hand, the electrical data alone will not differentiate between the orientation of polar groups or the translational motion of ions (called polarization) in a nonhomogeneous medium.

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AT low frequency both the dielectric constant and equivalent parallel conductance of water alone should be independent of frequency. Although the water adsorbed on the paper causes major changes in the electrical properties, the forces necessary both to rotate the molecules and to move the ions are different from those which would be required in water alone. This is in confirmation of experiments[13] which show that the heat of absorption of water on dry cellulose is about 50 per cent greater than the heat of condensation of water alone at 25 C. Therefore, it can be said that the changes in characteristics shown in Fig. 6 are not caused by free water. By subtracting the component of loss factor which represents the d-c conductance, the dotted curve in Fig. 6 is obtained, which is the frequency-sensitive component resulting from some form of electrical relaxation.

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REFERRING now to the data for dry paper (Figs. 4 and 5) it appears that the paper itself exhibits characteristics similar to the left-hand portions of the general curves for some relaxation mechanism and that increasing the temperature increases the apparent ease of relaxation and therefore the frequency at which a given change is observed.

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FIGS. 7 and 8 show similar results for oil-impregnated paper as though the low-viscosity mineral oil had little effect except to replace air in the paper matrix. This would not be true, however, if the impregnant used were polar or had high viscosity so that it, too, would show relaxation characteristics in the temperature and frequency ranges being studied.

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FROM the foregoing data for cable paper it may be seen that:

(1) At power frequencies (25 to 60 cycles per second) adsorbed water causes large undesirable increases in dielectric loss.

(2) At power frequencies dielectric relaxation effects are unimportant except at very low temperature.

(3) At radio frequencies the effects of moisture are less important than the dielectric relaxation effects.

✦ ✦ ✦

COIL WINDING PAPERS. Thin papers in considerable quantity are used in the winding of small coils for a variety of applications, as radios, meters, etc. Space is an important factor and the thickness of the sheet usually is between 0.001 in. and 0.003 in. The requirements are largely those just given for dielectric capacitor papers; coil-winding papers are manufactured in much the same manner. Undoubtedly the problem which has been given the most consideration has been the production of a sheet which would not corrode the fine copper wires with which it came in contact, particularly at high humidities and temperatures. Most of the effort was spent in reducing the acidity and the amount of electrolytes present. It has been shown recently[14] that the cause of the corrosion is the organic acids produced by the electrochemical oxidation of cellulose itself and that no degree of purification will prevent this reaction. These findings agree with the experience of other investigators who have tried papers made from all sorts of pulp at various acidities.

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SATURATING PAPERS. Large quantities of porous, absorbent papers are used for the manufacture of resin- and shellac-impregnated plates and cylinders. Such papers are usually manufactured on a Fourdrinier machine from kraft, rag, or alpha pulps. Their principal functions are to contribute mechanical strength, resiliency, and high dielectric strength through the process of lamination.

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LAYER INSULATION. In the process of winding electric coils, it is usually necessary to arrange the conductors in multiple layers. The electric voltage between these layers is many times higher than the voltage between adjacent turns. Therefore, sheets of paper are wound into the coil between the layers to provide the added insulation. The major requirements of layer insulation are high dielectric strength, toughness, type of finish, and freedom from conducting particles. This last requirement is so important that the conducting particle test is

(*Please turn to Page 468*)

[13] G. H. Argue and O. Maass: Can. Jr. of Res. 12, 564 (1935).

[14] H. N. Stevens and G. B. Gehrenbeck: Elec. Eng., 59, 357, June 1940.

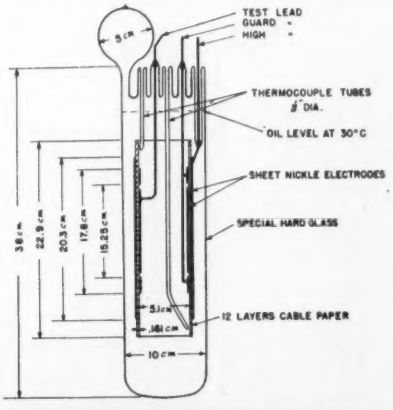

Fig. 9. Cylindrical guarded cell used for measurements on paper samples. ✦ ✦

The Importance of Laboratory Efficiency

By T. W. Fazakerley,
West Wickham, Kent, England

The writer of this article demonstrates briefly the various processes which form the operational activities of the laboratory and recommends that it is impossible for too great a value to be placed on the activities of that department.

UNTIL the years which succeeded the Great War of 1914-1918 the function of the laboratory in the majority of trades, including those concerned with the manufacture of wire and wire products, was of negligible extent. In the twenty odd years which have elapsed since 1918 the importance and appreciated value of the laboratory have steadily increased and, far from being what was then regarded in many cases as an unnecessary luxury, it is today the pivot on which production and sales must revolve.

✦ ✦ ✦

The Laboratory Function

BEFORE everything else it is essential that the immediate function of the laboratory should be clearly defined and that that definition is known and understood throughout the entire organization. The series of operations allocated to the laboratory vary from factory to factory, that department being expected to fulfill certain functions in one undertaking which would be entirely excluded from its activities in a neighboring organization. Unless a distinct dividing line is drawn between the functions which it should perform and those which it should not, the sectional efficiency runs the risk of being impaired. This applies particularly in the case of an undertaking of considerable size where production is governed by orders emanating from a Control Office and where the issue of various types of manufacturing instructions form part and parcel of a recognized procedure.

✦ ✦ ✦

THE Production Control Executive must appreciate that the laboratory is a necessary adjunct to production: the Sales section must be trained to believe in the importance of the chemist and these two departments should spare no pains to see that the chemists are made fully aware of the functional value of each and every article manufactured for disposal. Ignorance in these matters may bring about non-appreciation in a laboratory specification of the use to which a completed unit is to be put or the specification may lack co-operation in the fulfilment of the claims put forward for the individual products in the issued advertising matter.

✦ ✦ ✦

IT must be the prime duty of the laboratory to assume full responsibility for all matters relating to qualitative output and this responsibility will involve:

a. **the testing of all raw materials taken in.**
b. **the testing of various processes as work proceeds.**
c. **the testing at frequent but irregular intervals of the completed products.**

✦ ✦ ✦

IN order that there may be no oversight in the fulfillment of the chemists' duties, a system must be brought into being which will ensure that no goods purchased for use are actually allowed to move into the productive units until opportunity has arisen for the qualitative testing of samples. This testing is of particular importance when goods inward are purchased to a definite specification. Those tests which are executed must be made the subject of adequate records which will indicate the types of tests carried out and the results obtained. These statistics may prove to be invaluable evidence if, at a later date, doubts are raised or questions asked regarding the quality of a certain product.

✦ ✦ ✦

The Sub-Division of Laboratory Work

TO a very large extent the success or otherwise of every laboratory will depend on the schemes devised and the methods of operation instituted by the chief chemist in the allocation of the various tasks which his department is expected to carry out within the factory organization. The principal points to which he must direct his consideration will be found among the following six:

1. **the testing of raw material as well as semi-manufactured and finished products.**
2. **the maintenance of a qualitative control throughout the undertaking.**
3. **the preparation and issue of adequate manufacturing instructions.**
4. **the investigation and the control of the relationship existing between product quality and product cost.**
5. **experiments which will take time and which will ultimately result in the presentation of new products.**
6. **the furtherance of manufacturing instructions that will involve the economic utilization of by-products and all forms of manufacturing waste.**

✦ ✦ ✦

THE work of the chief chemist will be much simplified if he insists on each section of the laboratory submitting to him at monthly intervals a brief but comprehensive report describing the work undertaken and the results achieved. Such reports, with the constructive criticism which might well accompany them, should be submitted in consolidated form to the Management and in particular to the works General Manager.

(*Please turn to Page 466*)

Outstanding Personalities of the Wire Industry

Lt. Col. S. B. Ritchie, Ordnance Dept., U. S. Army

THE principal addresses delivered at the Pittsburgh Regional Meeting and the Worcester Regional Meeting were by Lt. Col. Ritchie; the topic being "Inspection of Army Materiel". The paper was published in the July issue of WIRE & WIRE PRODUCTS.

✦ ✦ ✦

LT. COL. RITCHIE was graduated from the U. S. Military Academy in 1917 and later from the Ordnance School, the Army Industrial College, and the Army War College. Served overseas with the A.E.F. during the World War. Since 1920, engaged largely on metallurgical activities in the Ordnance Department and on procurement planning work in the Office of the Assistant Secretary of War. Has been associated with the development of important Ordnance projects of a metallurgical nature. At present Director of Laboratory, Watertown Arsenal.

✦ ✦ ✦

Thomas F. Peterson, Director, Electric Cable Engr. and Research, American Steel & Wire Company

THOMAS F. PETERSON has been appointed Director of Electric Cable Engineering & Research of American Steel and Wire Co., subsidiary of the United States Steel Corp. His office will be located at the company's headquarters in Cleveland, where he will be connected with the office of the vice-president in charge of operations.

✦ ✦ ✦

BORN in Brooklyn, N. Y., on December 12, 1902, Mr. Peterson received his education in the public schools of Brooklyn, the Cooper Institute of Technology, New York City, and Leland Stanford University, where he received his Master's Degree in Electrical Engineering. His first employment was with the Brooklyn Edison Co. as cable engineer in charge of cable research.

S. B. Ritchie, Lt. Col., Ord. Dept., Director of Laboratory, Watertown Arsenal Watertown, Mass.

HE joined American Steel and Wire Co. in 1927 as cable engineer in the New York office. Later he was promoted to electrical engineer, and in 1931 was transferred to Worcester, Mass. In January, 1937, he was appointed Director of Electrical Cable Works at Worcester, which position he has held until the present time.

✦ ✦ ✦

Allegheny Ludlum Announces Personnel Changes

IT was recently announced that **A. F. Dohn**, vice president in charge of tool steel sales, Allegheny Ludlum Steel Corp., has retired. He will, however, continue in a consulting capacity as a vice president.

THOMAS F. PETERSON

✦ ✦ ✦

IN a move to correlate more closely production facilities of the two Allegheny Ludlum plants in the Pittsburgh district, at Brackenridge and West Leechburg, **Melvin C. Harris** has been appointed to the newly created position of district manager. Mr. Harris' entire career has been with the Allegheny Ludlum Steel Corp., beginning as a clerk in Allegheny's plate mill in 1915. He became general manager at Brackenridge in 1938 when Allegheny and Ludlum Steel interests were merged.

✦ ✦ ✦

MR. HARRIS is suceeded by **Carl B. Pollock** as manager at Brackenridge. He joined the Allegheny Steel Company in 1932 as superintendent of No. 2 department at Brackenridge subsequently becoming assistant general superintendent and general superintendent.

✦ ✦ ✦

SUCCEEDING Mr. Pollock, **George W. Evans**, since 1940 assistant general superintendent, Brackenridge plant, has been promoted to general superintendent. Mr. Evans joined the former Allegheny Steel Company in 1909.

✦ ✦ ✦

Paul Fielden, Director of Purchases, Norton Company

NORTON Company, Worcester, Massachusetts, has announced the appointment of **Paul Fielden** director of purchases. Mr. Fielden has been connected with the company 21 years as assistant credit manager and credit manager. He has been prominent in local and national credit men's associations and in 1937-1938 was president of the National Association of Credit Men.

✦ ✦ ✦

JOHN MILLER, for a number of years assistant credit manager of Norton Company, succeeds Mr. Fielden as credit manager.

(*Please turn to Page 474*)

STATISTICS --- MAY, 1941

PRODUCTION FOR SALE OF IRON AND STEEL PRODUCTS

AMERICAN IRON AND STEEL INSTITUTE
Capacity and Production for Sale of Iron and Steel Products

MAY - 1941

		Number of companies	Items	Annual Capacity Net tons	Production for Sale—Net Tons							
					Current Month				Year to Date			
					Total	Per cent of capacity	Shipments		Total	Per Cent of capacity	Shipments	
							Export	To members of the industry for conversion into further finished products			Export	To members of the industry for conversion into further finished products
Steel Products	Ingots, blooms, billets, slabs, sheet bars, etc.	34	1	xxxxxxxx	425,762	xxx	20,370	179,822	2,472,843	xxx	622,919	754,493
	Heavy structural shapes	7	2	4,730,200	398,497	99.2	11,739	xxxxxxxx	1,828,733	93.4	81,125	xxxxxxxx
	Steel piling	3	3	248,000	24,977	118.5	691	xxxxxxxx	104,812	102.1	11,612	xxxxxxxx
	Plates—Sheared and Universal	18	4	5,496,390	472,356	101.1	24,028	2,512	2,199,804	96.7	176,729	10,994
	Skelp	8	5	xxxxxxxx	91,949	xxx	19,165	33,299	441,071	xxx	69,349	180,499
	Rails—Standard (over 60 lbs.)	4	6	3,613,600	169,348	55.2	755	xxxxxxxx	776,124	51.9	32,144	xxxxxxxx
	Light (60 lbs. and under)	6	7	302,800	13,961	54.3	4,913	xxxxxxxx	80,957	64.6	31,751	xxxxxxxx
	All other (Incl. girder, guard, etc.)	2	8	102,000	2,115	24.4	114	xxxxxxxx	9,827	23.3	1,499	xxxxxxxx
	Splice bar and tie plates	14	9	1,210,600	72,315	70.3	1,367	xxxxxxxx	318,157	63.5	8,333	xxxxxxxx
	Bars—Merchant	34	10	xxxxxxxx	520,968	xxx	25,676	62,985	2,599,034	xxx	250,043	299,560
	Concrete reinforcing—New billet	15	11	xxxxxxxx	135,255	xxx	19,727	xxxxxxxx	589,723	xxx	96,963	xxxxxxxx
	Rerolling	17	12	xxxxxxxx	22,057	xxx	1,427	xxxxxxxx	67,871	xxx	4,913	xxxxxxxx
	Cold finished—Carbon	19	13	xxxxxxxx	108,374	xxx	1,416	xxxxxxxx	507,082	xxx	9,311	xxxxxxxx
	Alloy—Hot rolled	15	14	xxxxxxxx	143,678	xxx	12,607	14,089	656,222	xxx	63,206	65,164
	Cold finished	16	15	xxxxxxxx	17,895	xxx	2,016	xxxxxxxx	79,854	xxx	9,872	xxxxxxxx
	Hoops and baling bands	5	16	xxxxxxxx	10,381	xxx	234	xxxxxxxx	43,018	xxx	1,690	xxxxxxxx
	TOTAL BARS	52	17	11,600,185	958,608	97.3	63,103	77,074	4,542,804	94.6	435,998	364,724
	Tool steel bars (rolled and forged)	16	18	127,870	9,745	89.7	572	xxxxxxxx	45,496	86.0	3,353	xxxxxxxx
	Pipe and tube—B. W.	13	19	2,049,200	134,986	77.5	12,907	xxxxxxxx	640,698	75.5	51,533	xxxxxxxx
	L. W.	8	20	885,260	41,311	54.9	3,050	xxxxxxxx	197,304	53.9	14,044	xxxxxxxx
	Electric weld	4	21	466,020	46,458	117.3	7,981	xxxxxxxx	175,908	91.2	11,370	xxxxxxxx
	Seamless	15	22	3,003,840	182,765	71.6	17,029	xxxxxxxx	858,910	69.1	80,950	xxxxxxxx
	Conduit	6	23	152,145	11,719	90.7	263	xxxxxxxx	55,881	88.7	934	xxxxxxxx
	Mechanical Tubing	12	24	461,725	43,983	112.1	3,301	xxxxxxxx	196,107	102.6	19,367	xxxxxxxx
	Wire rods	19	25	xxxxxxxx	126,962	xxx	11,256	21,423	657,457	xxx	69,060	109,295
	Wire—Drawn	37	26	2,291,250	199,747	102.6	12,638	1,922	904,978	95.4	64,890	9,456
	Nails and staples	19	27	1,120,610	68,236	71.7	7,477	xxxxxxxx	346,653	74.7	29,859	xxxxxxxx
	Barbed and twisted	16	28	458,210	24,382	62.6	6,532	xxxxxxxx	119,320	62.9	27,527	xxxxxxxx
	Woven wire fence	15	29	771,180	28,991	44.2	106	xxxxxxxx	140,730	44.1	917	xxxxxxxx
	Bale ties	10	30	110,980	8,535	90.5	59	xxxxxxxx	32,088	69.9	99	xxxxxxxx
	All other wire products	5	31	24,280	659	31.9	-	xxxxxxxx	2,655	26.4		xxxxxxxx
	Fence posts	13	32	136,195	6,970	60.2	58	xxxxxxxx	30,431	54.0	479	xxxxxxxx
	Black plate	10	33	296,435	40,135	159.4	7,350	35	152,609	124.4	11,540	42
	Tin plate—Hot rolled	7	34	352,700	27,209	90.8	3,026	xxxxxxxx	111,499	76.4	7,567	xxxxxxxx
	Cold reduced	9	35	3,061,440	217,150	83.5	20,247	xxxxxxxx	919,222	72.5	75,956	xxxxxxxx
	Sheets—Hot rolled	23	36	xxxxxxxx	599,104	xxx	24,913	18,197	2,860,321	xxx	130,589	88,676
	Galvanized	13	37	xxxxxxxx	133,255	xxx	8,442	xxxxxxxx	714,490	xxx	52,702	xxxxxxxx
	Cold rolled	15	38	xxxxxxxx	237,413	xxx	4,390	xxxxxxxx	1,185,974	xxx	21,478	xxxxxxxx
	All other	13	39	xxxxxxxx	62,953	xxx	1,668	xxxxxxxx	311,883	xxx	9,083	xxxxxxxx
	TOTAL SHEETS	26	40	12,137,550	1,032,723	100.1	39,413	18,197	5,072,668	101.0	213,852	88,676
	Strip—Hot rolled	22	41	2,666,140	160,899	71.0	4,765	21,833	765,080	69.3	27,720	104,023
	Cold rolled	33	42	1,258,700	99,419	93.0	972	xxxxxxxx	468,193	89.9	4,711	xxxxxxxx
	Wheels (car, rolled steel)	5	43	422,825	22,026	61.3	87	xxxxxxxx	105,864	60.5	238	xxxxxxxx
	Axles	4	44	472,280	13,374	33.3	500	xxxxxxxx	71,664	36.7	882	xxxxxxxx
	Track spikes	10	45	319,435	14,993	55.2	129	xxxxxxxx	71,964	54.4	1,418	xxxxxxxx
	All other	4	46	24,100	3,358	164.0	-	xxxxxxxx	9,489	95.1	79	xxxxxxxx
	TOTAL STEEL PRODUCTS (a)	133	47	xxxxxxxx	5,196,563	xxx	305,963	356,117	24,907,500	xxx	2,189,804	1,622,202
	Pig iron, ferro manganese and spiegel	23	48	xxxxxxxx	581,304	xxx	46,927	157,847	2,972,665	xxx	223,767	885,247
	Ingot moulds	4	49	xxxxxxxx	62,481	xxx	591	xxxxxxxx	301,644	xxx	1,153	xxxxxxxx
Iron Products	Bars	9	50	109,195	5,716	61.6	7	364	25,786	57.1	16	1,413
	Pipe and tubes	3	51	109,300	6,223	67.0	530	xxxxxxxx	26,721	59.1	889	xxxxxxxx
	All other	2	52	71,000	1,035	17.2	-	-	7,799	26.5	1,181	-
	TOTAL IRON PRODUCTS (ITEMS 50 to 52)	11	53	224,995	12,974	67.9	537	364	60,306	64.8	2,086	1,413

Total Number of Companies Included - 150.

The estimated average yield of products for sale from ingots produced by the companies included above is 71.1 *%, which applied to their total ingot capacity equal* 54,980,400 *net tons of finished rolled products.*

Production for sale, less shipments to members of the industry for further conversion, related to the estimated yield is as follows:

Current month 4,840,446 *N. T.:* 103.6 *%*

Year to date 23,285,298 *N. T.:* 102.3 *%*

(a) Reported by 133 Companies, which in 1940 produced 91% of that Year's Total Output of Finished Rolled Products.

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RICHARD E. BROWN, Secretary
300 Main Street, THE WIRE ASSOCIATION Stamford, Conn.

Exports and Imports of Wire

Exports of Iron and Steel Wire Products in April 1941 and April 1940
(In gross tons)

	APRIL 1941	MARCH 1941	APRIL 1940
Wire rods	9,894	11,184	15,516
Strip steel	10,409	12,026	12,902
Plain black or galvanized iron or steel wire	11,768	10,841	11,774
Barbed wire and woven wire fencing	4,993	7,188	2,484
Woven wire cloth	323	326	225
Wire rope	1,385	731	754
Other wire and manufactures	1,513	959	2,061
Wire nails	4,902	4,191	4,414
Tacks	99	56	70
Other nails, including staples	694	986	373
Bolts, machine screws, nuts, rivets and washers	3,745	3,948	1,280
Total, these 11 classifications	49,725	52,436	51,853

Imports of Iron and Steel Wire Into the United States
(In gross tons)

Concrete reinforcement bars	.....	.....	.....
Hollow bar and drill steel	46	61	183
Wire rods	4	66	1,382
Barbed wire	.....	.....	44
Round iron and steel wire	.....	.....	277
Telephone and telegraph wire	.....	.....	.....
Flat wire and strip steel	672	162	392
Wire rope and strand	.....	31	60
Other wire	.....	.....	.....
Hoops and bands	.....	.....	112
Nails, tacks and staples	4	3	17
Bolts, nuts and rivets	.....	6	24
Total, these 12 classifications	726	329	2,491

United States Foreign Trade in Iron and Steel, Including Scrap Shipments, Rises

INCREASES were the rule in United States April foreign trade in iron and steel (other than scrap). Exports were up to 515,657 gross tons from the March total of 512,844 tons—the first increase in this trade since the record month of August 1940. Imports, too, were up—to 1,526 tons from the March total of 872 tons.

✦ ✦ ✦

CUMULATIVE 4-month exports totaled 2,208,161 tons—31 per cent above the 1,676,910 tons exported in the first 4 months of 1940. Cumulative imports present an opposite picture, with the 3,450 tons received through April 30, 1941, amounting to only 13.5 per cent of the 25,558-ton trade of the comparable 1940 period.

✦ ✦ ✦

PIG iron was, in point of tonnage, the chief export of this group of materials in April, the threefold rise lifting the month's total to 86,749 tons from the 27,464 tons shipped in March. Following was nonalloy steel ingots, blooms, etc., the trade in which totaled but 72,734 tons, in contrast with the 124,956 tons which moved in the month preceding. Other leading products in the April trade included alloy steel ingots, blooms, etc., 38,287 tons; nonalloy "other" plates, 34,320 tons; nonalloy black steel sheets, 29,300 tons; and tin plate and taggers' tin, 23,310 tons.

✦ ✦ ✦

THE 1,526-ton import trade was featured by the reported receipt of 672 tons of flat wire and steel strips and of 405 tons of rails and track material.

✦ ✦ ✦

Scrap Trade Rises

EXPORTS of scrap rose sharply in April to a total of 120,152 gross tons, or more than double the 54,383 tons exported in March. Even with this addition, cumulative 4-month exports are but fractionally as great as in the comparable period of 1940, totaling 293,968 tons against 850,253 tons.

✦ ✦ ✦

INCLUDED in the April 1941 total of 120,152 tons was 118,930 tons of iron and steel scrap. This total was comprised of 25,863 tons of No. 1 Heavy Melting Steel Scrap, 47,936 tons of No. 2 Heavy Melting Steel Scrap, 13,662 tons of baled and bundled scrap, 4,073 tons of cast and burnt scrap, and 27,396 tons of "other" grades of iron and steel scrap.

✦ ✦ ✦

SCRAP imports were down at 1,094 tons from the 5,401 tons received in March. Even so, cumulative figures for 1941 are running far ahead of 1940 — the 1941 figure being 6,662 tons and that for the earlier year being 1,226 tons.

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Iron and Steel Brazil

EXPORTS of iron ore through the port of Rio de Janeiro in the first 4 months of 1941 totaled 33,400 long tons, of which A. Thun & Co., Ltd., accounted for 17,450 tons.

✦ ✦ ✦

APRIL exports, totaling 23,730 tons, included 17,450 shipped by A. Thun and 15,950 tons by Cia. Servicos de Engenharia S. A. Of Thun's April exports, 10,700 tons were destined to the United States and 6,750 to Sydney, Nova Scotia, while Servicos de Engenharia's shipments went to England.

✦ ✦ ✦

STOCKS of iron ore held by Brazilian shippers at Rio de Janeiro at the close of April totaled 75,707 tons, compared with 87,275 at the end of March. Of the April stocks, only 3,898 tons were held by A. Thun & Co.

✦ ✦ ✦

Chile

IRON and steel products were in active demand throughout the first quarter of 1941. Increased building activity gave rise to persistent inquiries for many products, particularly reinforcing bars and black sheets.

✦ ✦ ✦

THE United States is the primary shipper to Chile. Offers from continental Europe have ceased, and Japan is likewise absent from the Chilean market. Great Britain continues to offer limited quantities of certain products, although deliveries are uncertain. Canada is offering limited quantities of pipe.

(*Please turn to Page 456*)

Exports & Imports of Wire

(*Continued from Page 455*)

WHILE export quotations for American iron and steel products have not increased appreciably, Chilean importer-distributors, favored by a sellers' market, are said to have increased their prices considerably.

✦ ✦ ✦

STOCKS held in Chile were below normal in the first quarter of 1941. At the close of March a noticeable scarcity of black sheets for galvanizing sharply curtailed activity in Chile's largest galvanizing plant.

✦ ✦ ✦

PRODUCTION of iron and steel products continued normal during the first quarter, with slight increases in output of reinforcing bars and electric-furnace products. Domestic output fills only a small part of the country's requirements of these commodities.

✦ ✦ ✦

China

EXPORTS of iron ore in 1940, totaling 2,303,613 quintals (1 quintal equals 220.4 pounds) were 126 per cent above the 1939 shipments. In 1936 and 1937 Chinese exports of iron ore were predominantly from the Yangtze ports of Wuhu and Hankow; but in 1938 and 1939, shipments were almost entirely from North China. Details for 1940 are not yet available, but it appears likely that most of the exports during the period were also from North China.

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IN the first 2 months of 1941, exports of iron ore from Japanese-controlled Chinese territory totaled 449,935 quintals, of which Japan proper took 449,920 quintals.

✦ ✦ ✦

THE Japan Proper Mining Co., exploiting the former Chinese-owned Hsiang Pi Shan iron mine at Tayeh, Hupeh Province, is planning to expand its present monthly production of 10,000 tons of ore. The entire output of this company is shipped to Japan. Output of the principal Yangtze iron mines under Chinese management in 1936 totaled 1,340,220 tons, of which 200,000 tons were produced by the Hsiang Pi Shan mines.

✦ ✦ ✦

IN order to expedite shipment of iron ore from the Tayeh and Wuhu mines via the Yangtze, it is reported that Japan has decided to build three special freighters for transportation of the ore.

✦ ✦ ✦

Chosen

THE iron and steel industry of Chosen has been greatly stimulated by the growing demand resulting from the present war emergency. Shortage of fuel and hydroelectric resources in Japan Proper has also tended to increase demand for iron and steel produced in Chosen.

✦ ✦ ✦

THE Oriental Development Co. and the Daido Steel Mfg. Co. will form a joint company this summer, known as the Chosen Daido Steel Mfg. Co. and plans to erect a plant near Heijo for the production of steel in electric furnaces. Iron ore will be imported from Tungbentao, Manchuria, while coal from the Heijo region will be utilized. There is believed to be an

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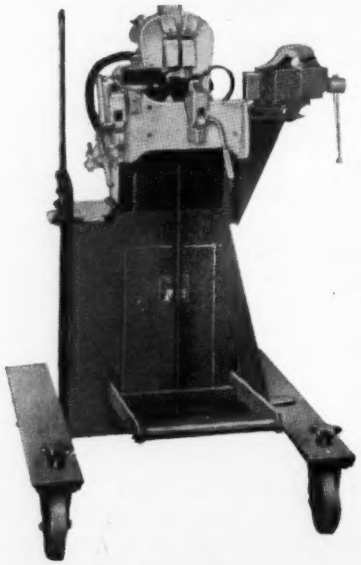

MICRO PRODUCTS COMPANY
20 NORTH WACKER DRIVE, CHICAGO, ILL.
Telephone, State 7468

abundance of electric power in South Heian Province where the plant is to be located.

✦ ✦ ✦

Egypt

A SERIOUS shortage of practically all classes of iron and steel products exists in the Egyptian market. Egypt has no steel industry, and all iron and steel products other than those produced in the small native iron-working shops must be imported.

✦ ✦ ✦

IMPORTS of iron and steel products prior to the outbreak of hostilities in September 1939 came chiefly from Belgium, the United Kingdom, Germany, and the United States; the American participation totaled only about 20 per cent. Since the closing of the Mediterranean to commercial shipping in June 1940, the United Kingdom and the United States have become practically the sole suppliers.

✦ ✦ ✦

AMERICAN quotations on iron and steel during the past several months are reported to have been highly competitive with prices asked by British manufacturers. It is asserted that, despite the higher cost of freight and insurance on goods from the United States, in addition to the high rate of exchange for the dollar which has prevailed since the outbreak of the war, American suppliers could readily have obtained the bulk of the available business if they had been willing to accept irrevocable letters of credit in New York, payable against ocean bills of lading. Egyptian importers, in their eagerness to obtain their requirements at the attractive prices quoted by American manufacturers, have made every effort to induce the Egyptian Government to permit them to meet the requirements of American suppliers, but thus far without success.

✦ ✦ ✦

Iran

A COPPER refinery is being built in Iran at Ghaniabad, in the vicinity of Tehran. It was reported early in February that negotiations were under way for the purchase of equipment from an American firm.

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Rats In The Corn Crib

(*Continued from Page 444*)

with no vestige of demand in sight. Next thing we knew we had streamlined trains on aluminum chasses.

✦ ✦ ✦

Q. But **Alcoa** is a monopoly, isn't it?

A. I suppose so, Buddy. By the current definition, a monopoly is any successful business run by the Republicans. By the older definition a monopoly is something that only one man had guts enough to pioneer and now everybody wants to chisel in on. **Alcoa** qualifies both ways. **Mellon** is charged with having secured a monopoly on raw materials. He was no fool. He had his scouts out to locate all the best sources and nail them down by purchase, lease, or concession. Was that ordinary prudence, or was it a crime against humanity? What should he have done — turned them over to the nation? The nation would have laughed at him and given them back to the Indians. The New Deal never forgives a man for having sense—it's a thing they can't understand.

But as for this monopoly, three years ago, when the New Deal had eleven suits pending against **Alcoa**, I decided to find out how much this octopus was taxing the American people. I checked up prices of the metal in the four chief producing countries. Our octopus was giving us the lowest price in the world. That's the kind of monopoly I like.

Now **Honest Harold** is vilifying **Alcoa** for not having in stock the metal that will be required in 1942 for planes whose specifications are still unwritten. That's as near as I can estimate. As a matter of record, when **Harold** opened the order books at Bonneville Dam, **Alcoa** stepped up with an offer to take a substantial percentage of his current. **Harold** popped up with a resounding refusal. This current was for the **People,** not the predatory interests, said **Harold,** seething with righteous indignation. So he proceeded to load up the neighboring yokels with radios, permanent wave machines, hot plates, hot water heaters and

the like, on the government cuff, and **Alcoa** didn't get their plant. That little gesture has cost U. S. and Britain about 650 planes, to date, and it is estimated that before **Harold's** stooge company gets into production it will have cost them 1100 more. If **Roosevelt** worried half as much about getting supplies from an established source as he does about setting up competing sources, and government yard-stick plants, we'd be about 1800 bombers richer.

Incidentally the **House-Military Affairs Committee** reports **"all the testimony given before this committee was to the effect that the Aluminum Company of America not only used its own money for expansion, and lowered prices, but of its own initiative trebled its production."**

Q. Correct me if I'm wrong, **Mr. Whoosis,** but you seem not to trust your government implicity.

A. A masterpiece of understatement, sonny. We are being exhorted to fight with every ounce of energy to prevent the destruction of our cherished institutions by foreign dictators, at the moment when **Roosevelt** is using his vast powers legally and illegally to fasten upon us the identical system of which he warns us. **Hitler, Stalin, Mussolini, Roosevelt,** the only difference I see between them is one of degree, or rather, of method, and perhaps of national character. The poor dupes of the Continental dictators have been accustomed for a thousand years to bend their necks to some form of tyranny. Without a dictator they would feel naked. We Anglo-Saxons, (I except the Asiatics in our midst, who have never really got the idea) have eight or nine centuries of self-government in our pedigree. Our dictator must move very slowly at first, and lull us to sleep by prating about "emergency powers." A dictatorship always moves from crisis to crisis; the emergency is permanent. When will our dumb voters learn that?

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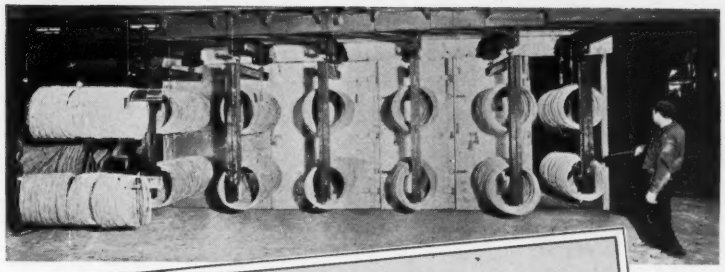
Q. Don't you realize, **Mr. Whoosis,** that your frame of mind scarcely contributes to that unity

(*Please turn to Page 462*)



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Defense Savings Bonds

THE American people are saving at the rate of $100,000,000 a week!

✦ ✦ ✦

THIS is not somebody's wild guess, but an official announcement by the Treasury Department, that Americans are giving Uncle Sam $100,000,000, a week to save for them—and receiving in return Defense Savings Bonds and Stamps.

✦ ✦ ✦

BANKERS, businessmen, bakers, farmers, factory workers, shop girls, housewives — virtually all American men, women and children from all walks of life — are cooperating in the Government program to build up a rainy-day reserve. In many states, employers are establishing systematic savings plans in cooperation with their employees. Labor and industry both have endorsed the Savings Program of the Government. Nevertheless, there are still many who ask: Why? What is the reason for this National thrift undertaking?

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THE reasons are manifold. Strange as it seems, with war all around us, America is preparing for peace. In this period of unlimited emergency, vast requirements are being made of industry by the Federal Government. Wheels are turning at top speed to produce the weapons of defense — weapons that will assure and protect the freedom and safety of the nation. As a result, the national income is jumping sharply. Wages and salaries are increasing. So, too, is employment. Money is more plentiful.

✦ ✦ ✦

IF the country spends a lot of money now, there may be a letdown afterwards. The Defense Savings Program of the Treasury Department involves the sale of Federal securities to as many people as possible in an effort to build as large a reserve as possible against any slump which follows the end of America's all-out war production.

✦ ✦ ✦

THE cash involved in the purchase of Defense Savings Bonds is put to work at once to protect the freedom of the country. At the same time, the bond protects the individual against financial consequences of a post-war readjustment. Thus, the program achieves a two-fold purpose.

✦ ✦ ✦

THERE are three types of Defense Savings Bonds, designed to meet the needs of all people. The Series E, or "people's bond", however, is the one of particular interest to the average American man, woman and child. This investment preserves the character of the Savings Bonds which have proved so popular since they were first put on sale March 1, 1935.

✦ ✦ ✦

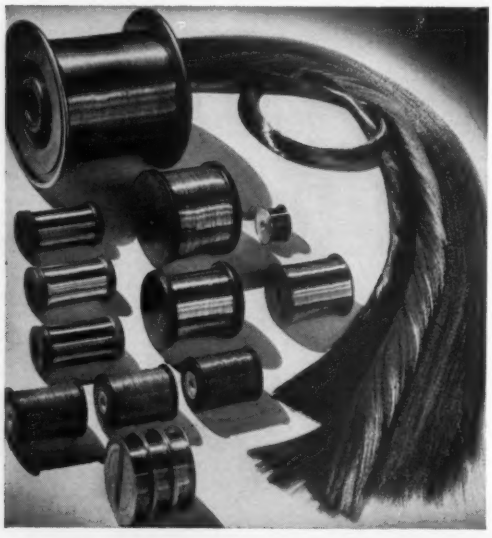
THESE Series E Bonds may be bought for $18.75, $37.50, $75, $375 and $750. They grow in value in ten years to $25, $50, $100, $500 and $1,000, respectively. The annual investment yield is 2.9 per cent a year, compounded semi-annually, when a bond is held to maturity in accordance with a table of redemption values printed on the face of the bond.

✦ ✦ ✦

SERIES F, also an appreciation bond, is issued at $74, $370, $740, $3,700 and $7,400. These bonds mature in 12 years to $100,

ACCURACY DEFINES CALLITE FINE WIRE

Accuracy to size, accuracy in roundness — two taken-for-granted qualities of Callite fine wire. Stressed here because today, experience has shown, even wire can be a costly bottleneck in production. If you are confronted with such a wire problem, consult our engineers. You can rely on the uniform elongation and tensile properties of Callite fine wire to speed up production and lower operating costs. Characteristic Callite thoroughness, and close control of heat treatment combine to produce a uniformity of specifications from one order to another. Investigate.



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Callite wires are available in aluminum, beryllium-copper, stainless-steel, phosphor-bronze, Everdur, brass — all grades as well as commercial bronze, nickel-silver alloys and special alloys. In fine wire sizes down to .002". Write for complete details.

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$500, $1,000, $5,000 and $10,000. Series G is designed to meet the demand for a current income bond. These are issued at par and may be purchased in denominations of $100, $500, $1,000, $5,000 or $10,000. Series G Bonds bear interest of 2.5 per cent paid semi-annually by Treasury check.

✦ ✦ ✦

IN addition to individuals, these two series of bonds may also be registered in the name of any corporation, association, partnership or trustee.

✦ ✦ ✦

IF an individual should be pressed for cash, the Treasury will redeem the bonds before maturity. The full faith and credit of the United States Government are behind all of these bonds.

✦ ✦ ✦

DEFENSE Savings Stamps are for the convenience of purchasers who cannot afford to pay $18.75 at any one time. These stamps, on sale at post offices throughout the country and at many other outlets, are issued with handy devices for safe keeping. On the purchase of a 10-cent stamp, a card is furnished for mounting 25 of these stamps which may then be exchanged for $2.50 worth of the larger sizes. With the purchase of a 25-cent, 50-cent, $1 or $5 stamp, an attractive pocket album is given free in which to mount the stamps, which may be exchanged later for a bond.

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SECRETARY Morgenthau has announced that the Treasury's Defense Savings Program is to be a continuing effort.

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"THERE are no quotas for the country or for any community in it", is the way the Treasury Secretary phrases it. "There is no time limit. A major object of this program is to give the American people the habit of systematic saving for their country's sake and for their own".

This is an invitation for you to become a member of The Wire Association.

The Annual Dues are $10.00

Cuba

AS a result of increased United States demand, development of Cuba's manganese deposits is being sharply accelerated. Production of manganese ore in Oriente Province, the leading producing area, is estimated to have reached a total of 20,000 tons during the month of April. The manganese ore concentration plant in El Cristo, operated by the Cuban Mining Co., is said to be the largest in the world, producing about 360 tons of 50 per cent manganese a day. Many Cuban firms and individuals are exploiting manganese deposits, the aggregate output of which is said to approximate that of the monthly production of the Cuban Mining Co. In addition to the output of the Oriente Province, manganese ore is also produced in the Provinces of Pinar del Rio and Las Villas. It is reported that consideration is being given to the erection of a concentrating plant in the latter province. Manganese mines are also operated in the Guanayara area of Trinidad.

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SPOOLS and REELS

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V The skill and experience to make them right.

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Widely used in the wire industry for production operations and shipping, "American" Pressed-Steel Spools are light, clean, and sturdy. They will not break, chip, crack, or warp.

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AMERICAN
Pressed-Steel
SPOOLS AND REELS

Rats In The Corn Crib

(*Continued from Page 459*)

that the pending war makes so essential?

A. I know it very well; it is an appalling thing to have to face, but disunity is here, and there's no use sweeping the dirt under the bed. **Roosevelt** is appealing to us to make an end to bickering and back-biting. Might we not ask him to set us an example? Who struck the first blow? Out of one side of his mouth he urges us to produce, produce, produce, and out of the other he cheers on the hatchet men, who harass us with law suits and extra-legal persecution and poison our employees' minds against us. Why be mealy-mouthed about it? We want to know whether the ghastly farce being played before us in the defense program is just the natural result of having to entrust such matters to stumblebums, or whether they are deliberately misusing the defense program to intensify their economic warfare against the system of competitive individualism under which we have grown great. The successive skirmishes are suspiciously alike—fantastic needs of expansion and alleged shortages in almost every major industry are harped upon by the New Dealers. Then the Administration steps in to finance or to build competing plants. Faster and faster they are crowding us toward that situation which the old darkey described as "Gov'ment do everythin'."

✦ ✦ ✦

Q. Aren't you afraid, **Mr. Whoosis,** that you may be mistakenly accused of disloyalty, and of lack of enthusiasm for our defense preparation?

A. Sir, my loyalty is to my country, not to the apes who are mis-governing it. As for them, the low, lousy, misbegotten sons of —— whoops! —— stop me somebody, this is bad for my blood pressure! Thanks, my boy; yes, just a swallow. Where was I? Oh yes, loyalty. I know I am accused of a lack of patriotism, and I resent it. I was in there pitching in the last war, and I'll be in there again. But I want to remind you that no pitcher can take his full wind-up with men on bases. How am I going to get up any enthusiasm about facing **Hitler** knowing that right at my back is the meanest, craftiest, double-crossing—yes, yes, you're right, and thanks for reminding me.

All I can say is that they're a different breed. I hate their guts, as they hate mine. They knife me every time I turn my back, and I'll take a swing at them every time they stick up their damned heads. I've been doing it for eight years; I'll keep on till the firing squad gets me, and then, by Godfrey, they'd better sound-proof the coffin lid.

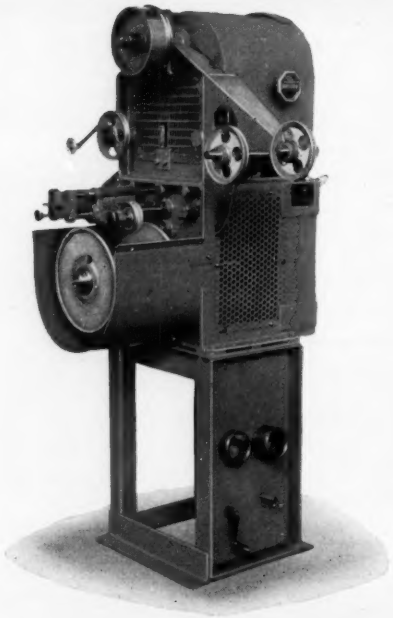
Q. Well, **Mr. Whoosis,** thanks very much for an interesting interview. I'm going to send it to **Dick Brown,** but he probably won't publish it.

Modern design . . . . . .
of Syncro fine wire Take-Up offers
Many important advantages

The new Syncro take-up for #17 to #30 copper wire is equipped with a shock proof starting and stopping device. This is designed so the capstan is disengaged until the spool is rotating at the desired speed, when the capstan is automatically engaged, giving a smooth shockless start which virtually eliminates wire breakage. When stopping the machine, the capstan is automatically disengaged, which prevents the momentum of the spool from increasing the wire tension to the breaking point.

This machine is equipped with the Syncro magnetic slip clutch with which wire tension is controlled, and with a manually controlled variable speed unit with which wire speeds of from 300 to 1500 F.P.M. can be obtained. A direct reading tachometer constantly shows the wire speed in feet per minute.

Write for a complete list of the many advantages offered by this new Syncro fine wire take-up.



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Drawing and Annealing Oven

THROUGH the improvement and development of an older furnace, the Despatch Oven Company of Minneapolis, Minn., has just made available a new furnace that is said to offer outstanding advantages in tool room tempering and drawing work, to the heat treatment of aluminum rivets and other aluminum castings and parts, to the preheating of aluminum billets before forging, to the heat treatment of magnesium alloy coatings and to general production work requiring a temperature range from 300 to 1200 degrees F.

✦ ✦ ✦

THE body construction of the furnace has been made a great deal heavier and heavy duty lift doors have replaced former swing type doors.

✦ ✦ ✦

FAN capacities have been increased and method of interior heat distribution and circulation has been modified to give better uniformity than formerly assured.

✦ ✦ ✦

STANDARD furnaces in this line range from 13″ x 13″ to 37″ x 25″. Special sizes can be quoted upon request. These new furnaces are available with either gas fired or electric heating systems.

✦ ✦ ✦

THE furnace is equipped to use gas, with a standard atmospheric burner and refractory combustion chamber, along with their "controlled combustion", a feature that is said to provide high combustion efficiency under all operating conditions. The "controlled combustion" consists of an adjustable back pressure baffle that maintains correct combustion chamber temperature and obtains maximum heat from the gas being burned. No blowers or factory air supply is required. Heating elements can be replaced without cooling the load or furnace interior.

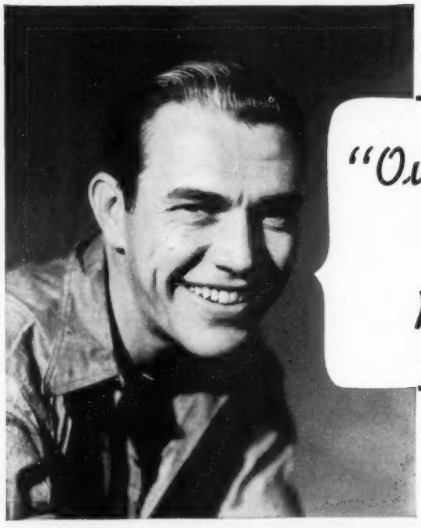
✦ ✦ ✦

IF detailed information is desired, it may be had by writing the Despatch Oven Company for Bulletin Number 83, or the Editor, WIRE & WIRE PRODUCTS.

✦ ✦ ✦

El Salvador

THE year 1940 was slightly better than average in the iron and steel trade, construction work being quite active. Preliminary statistics indicate that the United States supplied about 89 per cent of the imports of iron and steel in 1940. In quantity, round iron rods, 5 to 50 millimeters in diameter, were the chief item of import; of the 1,267 tons imported, the United States supplied 1,094.



"Our Solder Problem was Solved Right Away,"

Said Wire Products Production Men

Production men in the wire products field have learned that any problem involving solder can be solved quickly and finally, with the help of Kester engineers. Backed by experience of 42 years, and with complete, modern laboratories at their command, Kester experts are in the best possible position to study your requirements and arrive promptly at the right answers.

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KESTER CORED SOLDERS
STANDARD FOR INDUSTRY

A Review of Recent Wire Patents

No. 2,243,837, METHOD OF AND APPARATUS FOR WINDING ELECTRICAL COILS, patented June 3, 1941 by Arthur G. Bugler, Hinsdale, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

This method comprises the steps of transferring a predetermined length of wire from a supply thereof to a storage member, and then winding a coil having a plurality of doubled turns by simultaneously withdrawing wire from the supply and the storage member.

✦ ✦ ✦

No. 2,243,853, METHOD OF INHIBITING CORROSION, patented June 3, 1941 by James B. Castner, Woodbury, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del., a corporation of Delaware.

In order to inhibit corrosion of steel this inventor coats it with an inorganic nitrite.

✦ ✦ ✦

No. 2,244,046, SCREW, patented June 3, 1941 by Granville Bradshaw, London, England, assignor to The Bradshaw Patent Screw Company (Foreign) Limited, London, England, a British company.

The head has a smooth unthreaded axial recess, the inner part of which has sides which are substantially parallel to the axis, and constitutes a socket for receiving a self-tapping thread on a screw driving tool, and the outer end of

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

which is formed to a wide angle taper and constitutes a non-binding friction clutch surface adapted to transmit substantial torque and endwise pressure.

✦ ✦ ✦

No. 2,244,422, WOVEN WIRE BELTING, patented June 3, 1941 by Raymond J. Guba, Philadelphia, Pa., assignor to Audubon Wire Cloth Corporation, a corporation of New Jersey.

A number of rigid sections are provided, each connected with a hinge rod to form a continuous fabric, each section including a plurality of interwoven helical coils having the turns of each overlapping and interlocking with the turns of adjacent coils, a cross rod extending through each of the coils between the turns thereof and the overlapping turns of each adjacent coil, and means hinged on the hinge rod and rigidly connecting the ends of each cross rod to the adjacent ends of the other cross rods in the section to maintain the coils in the same plane.

✦ ✦ ✦

No. 2,244,543, MATTRESS OR CUSHION AND METHOD OF MAKING THE SAME, patented June 3, 1941, by Howard Herrmann Seavert, Kenosha, Wis., assignor to Simmons Company, New York, N. Y., a corporation of Delaware.

Both the boxing and inner spring construction are connected by helical wire means, embracing certain of the intermediate portions and the adjacent spring coil portions of the inner spring construction.

✦ ✦ ✦

No. 2,245,525, LOCKING MEANS, patented June 10, 1941 by Ralph W. Dicely, Lancaster, Pa., assignor to Mac-It Parts Company, Lancaster, Pa. a corporation of Pennsylvania.

More specifically, a set screw is provided, formed at its leading end with a smooth surfaced substantially conical cup concentric throughout to the rotational axis of the set screw and of uniform radius in any given plane perpendicular to this axis, and a sharp annular leading edge defining the mouth of the cup, the surface of this cup being interrupted at regularly spaced intervals by a number of radially extending locking grooves so spaced and disposed as to leave a smooth unbroken substantially conical surface portion between each adjacent pair of the locking grooves.

✦ ✦ ✦

No. 2,245,766, SELF-SUPPORTING HOLLOW CONDUCTOR FOR ELECTRIC CABLES, patented June 17, 1941 by Werner Dorfel, Berlin-Siemensstadt, Ernst Fischer, Berlin-Lichterfelde, and Hermann Lintzel, Berlin-Siemensstadt,

THE WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE AND WIRE ROPE MACHINERY

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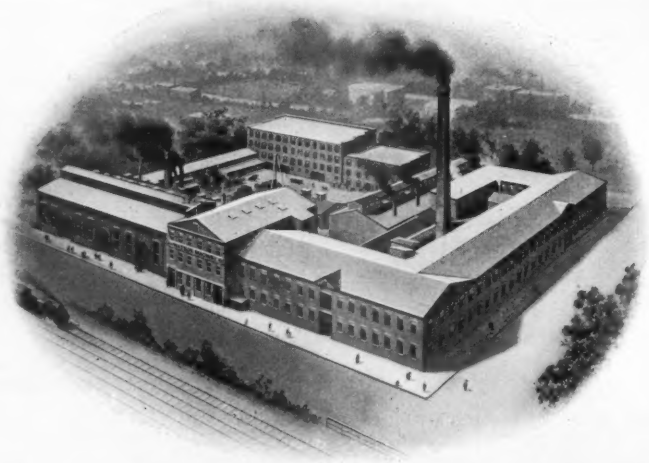

Let-offs
Gang-Spoolers
Re-winders
Capstan Takeups
Continuous Takeups
Heavy-Duty Takeups
Traverses
Measuring Mach.
Testing Mach.
Vulcanizers
Polishers
Reel Crutches

MEAS. MACH., TRAVERSES, REEL CRUTCHES, BUNCHERS, SMALL POWDERERS, ETC.—USUALLY CARRIED IN STOCK

LITERATURE AVAILABLE ON ALL LISTED UNITS

Germany, assignors to Siemens & Halske, Aktiengesellschaft, Siemensstadt, near Berlin, Germany, a corporation of Germany.

A band structure is provided, forming a tube and having its abutting edges movable relative to each other, and band structure having transverse grooves, the grooves having their ends abutting against a straight portion of the adjacent edge of the band structure so as to prevent the abutting edges from slipping over each other.

✦ ✦ ✦

No. 2,246,124, ARMORED CABLE CONSTRUCTION, patented June 17, 1941 by George Carlson, Bridgeport, Conn., assignor to General Electric Company, a corporation of New York.

The wire conductors are twisted together around a longitudinal strip of insulating material to form an S-shaped wrap closely engaging the outer peripheries of the conductors and having a central portion positioned between the conductors and a helical metallic armor closely engaging and surrounding the S-shaped wrap and insulated conductors.

✦ ✦ ✦

No. 2,246,840, APPARATUS FOR HANDLING METAL STRIP, patented June 24, 1941 by Edward V. Crane, Brooklyn, N. Y., and Alvin F. Groll, Toledo, Ohio, assignors to E. W. Bliss Company, Brooklyn, N. Y., a corporation of Delaware.

Means is provided, after coiled metal strip is straightened, to guide the straightened metal in a loop having a radius sufficiently great to prevent the metal from again taking a permanent set.

✦ ✦ ✦

No. 2,247,248, WIRE DRAWING BLOCK, patented June 24, 1941 by Weld Morgan, Worcester, and John N. Whalen, Boylston, Mass., assignors to Morgan Construction Company, Worcester, Mass., a corporation of Massachusetts.

This block construction comprises a central hub, an annular capstan portion surrounding the hub and spaced radially therefrom, a plurality of spokes extending outwardly from the hub to the capstan portion, the spokes being spaced apart to provide passages for the flow of air and a series of thin ribs extending inwardly from the capstan portion into the passages.

✦ ✦ ✦

Welding Society Announces Tentative Program

THE American Welding Society announces that plans for its Annual Meeting and Convention, to be held in conjunction with the National Metal Exposition in Philadelphia, October 19th to 24th, are nearing completion. With welding playing a role of primary importance in defense and with interest in various welding processes on the increase, this year's meeting promises to be more outstanding than usual.

✦ ✦ ✦

HEADQUARTERS for technical sessions, committee meetings and social events will be the Bellevue Stratford Hotel. The opening session starts Monday morning, October 20, 1941, at 9:30, with the presentation of medals and prizes. Technical sessions continue throughout the week, and the annual banquet of the Society is planned for Thursday evening.

✦ ✦ ✦

MORE than 65 technical papers covering several phases of welding, cutting and treating processes will be presented at the sessions by authorities in their respective fields. Separate sessions on machinery manufacture, shipbuilding, training of operators, aircraft, automotive and railroad work, structural welding and welding of defense and armament equipment are scheduled. Other sessions will be devoted to research and metallurgy.

Make your plans now to attend the Annual Convention of The Wire Association to be held at the Hotel Philadelphian, Philadelphia, Pa., October 20-24, 1941.

✦ ✦ ✦

IN addition to the technical sessions, manufacturers of welding equipment and supplies will display instructive industrial exhibits at the Philadelphia Commercial Museum and Convention Halls.

SMOOTHER WIRE SURFACE AND LESS DIE WEAR

WITH **TECO** CARBIDE WIRE DRAWING **DIES**

If you want finer finished wire . . . longer lasting dies . . . definite wire drawing economy, specify Teco Carbide Dies. A near-diamond hardness combined with experienced engineering accounts for Teco's superior performance. This combination gives wire processed through Teco Carbide Dies smoother, more uniform finishes, gives you substantially longer die life and lower cost through increased production. A Tungsten Electric engineer will be glad to discuss your wire drawing problems and point out, in your own plant, how Teco Carbide Dies reduce wire drawing costs and increase efficiency all down the line. Investigate!

Pioneers in Tungsten Carbide for over a Quarter of a Century

NEVER SAY DIE . . . *always specify*
TECO CARBIDE DIES
for smooth wire drawing . . . THEY LAST LONGER
Tungsten Electric supplies carbide blanks, tools, bits. Wire and bar dies, tubing, extruding and sizing dies. Also, special tools, such as spot facers, reamers, broaches, form tools, etc.

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The Importance of Laboratory Efficiency

(*Continued from Page 452*)

The Allocation of Laboratory Responsibility

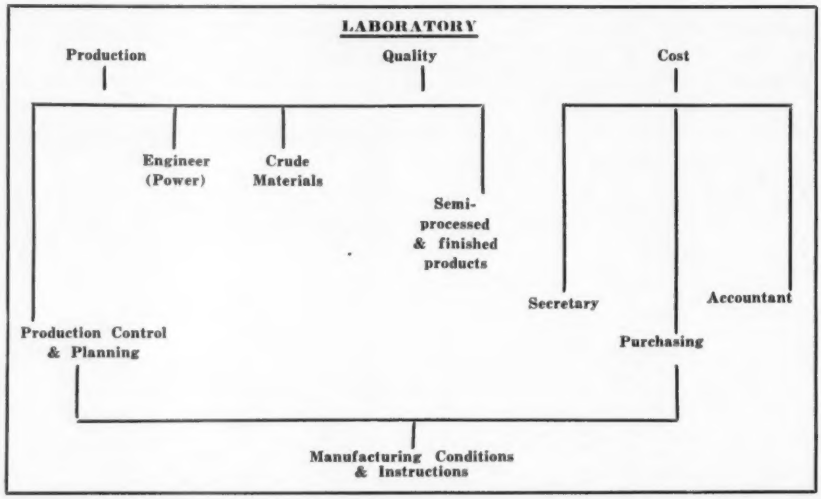
BEFORE steps are taken to determine the functional activities of the laboratory in any organization it is an essential precedent to consider in what manner responsibility for the work of the laboratory shall be allocated. Naturally enough, departmental responsibility will be assumed by the chief chemist but he, in his turn, must have a higher authority to whom he can turn and to whom he can submit his reports. On this subject, opinions differ from case to case, one maintaining that the General Manager is the correct individual for the ultimate authority whilst another will hold that the Works Manager should be appointed as consultant-supervisor. The writer prefers to take no side in the argument as decisions will vary in accordance with the domestic value with which the laboratory is regarded. A definite opinion will however be given and that is that non-appreciation to the utmost of the functional value and utility of the laboratory by any section of the management cannot but result in a decrease in that section's efficiency.

✦ ✦ ✦

IN organizations both large and small, the Chemist has a role to fulfill and his activities must bring him in direct and close contact with every sales and factory executive. Only the closest co-operation between all members of the executive and the harmonious working one with the other of all factory departments will permit the realization of the possibilities which accrue from the maintenance of a laboratory.

✦ ✦ ✦

THAT the laboratory is associated with almost every department in production schemes is demonstrated by the following chart.



ARE YOU COMING TO PHILADELPHIA, PA. OCTOBER 20-24, 1941

To Attend The Eleventh Annual Convention of the Wire Association?

✦ ✦ ✦

CONVENTION HEADQUARTERS WILL BE AT THE HOTEL PHILADELPHIAN

✦ ✦ ✦

A splendid opportunity is offered to discuss informally, routine production problems and to exchange opinions and ideas regarding equipment and processes used in the industry.

For this purpose informal gatherings are held at the Wire Association headquarters in the Hotel Philadelphian, which are open from 9 A. M. to 11 P. M. during the convention.

Every wire production executive engaged in the manufacture or fabrication of wire and wire products of any kind is invited to join The Wire Association and attend these meetings.

✦ ✦ ✦

THERE WILL BE A REGISTRATION FEE OF $5.00

✦ ✦ ✦

MAKE YOUR PLANS NOW TO ATTEND

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For detailed information on Program, Membership, Hotel Reservations and Transportation

Address RICHARD E. BROWN, Executive Secretary

300 MAIN STREET STAMFORD, CONN.

What Will Peace Bring?

THAT we shall have a serious problem of price readjustment in any peace following the present war, is one of the conclusions in a recent study of problems and opportunities after the war, issued by **Farrel-Birmingham Company, Inc.,** Ansonia, Connecticut. The study appears as the latest of the company's familiar series of booklet editorials.

✦ ✦ ✦

THIS study briefly outlines some of the problems and the opportunities of the postwar period as they may affect the United States, including price readjustment, future armament expenditures, the national policy of imperialism and the outlook for industry.

✦ ✦ ✦

"OUR present tendency in thought," the study states, "is to base our thinking and perhaps our concern about the future peace upon the isolationist national policy of the post-World War period. From that standpoint, the problems of peace appear to far outweigh the opportunities. Should, as now seems almost certain, we accept the scepter of empire with Britain as a junior partner, the problems will remain, but the opportunities may well serve to more than offset them.

✦ ✦ ✦

"WE shall probably have the responsibility, with both the problems and opportunities, of an imperial power. Our national policy already is becoming one of expansion southward and westward. After the war we shall probably inherit the position so long occupied by England as the dominant world power. The necessary concomitants of armament, shipping and commerce may possibly provide the stimulus to industry necessary to cushion the postwar readjustment.

✦ ✦ ✦

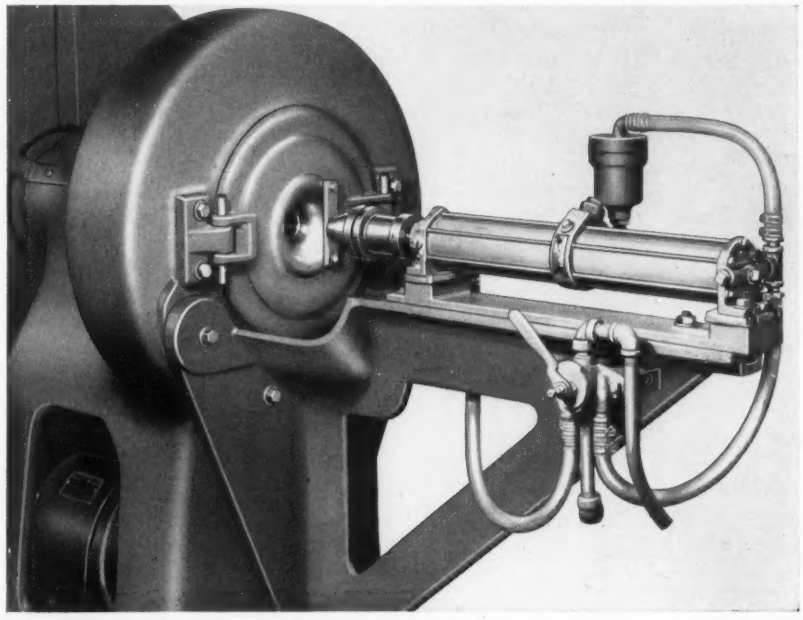
"WE shall have a serious problem of price readjustment, which doubtless will be approached for solution by the subsidy route and possibly by another devaluation of the dollar.

✦ ✦ ✦

"WE shall have the equally serious political problem of halting the further growth of Statism. Whether we shall find that the responsibilities of empire will bring a return of the conservative viewpoint and a resurgence of individual enterprise no one can predict. It is possible, perhaps even likely, that disillusionment of the nation by published war objectives and peace terms will restore or recreate a realistic understanding of the evils of Statism. Certainly, education of our youth and the steeling of the older generation against further dependence upon the State will contribute to a return of the American System as we know it.

✦ ✦ ✦

"WE shall either capitalize the opportunities or be overcome by the problems of peace. From present knowledge, necessarily incomplete, it can be seen that as an empire we may find the opportunities more than counterbalancing the problems; as an isolationist nation the reverse may well be true."



Banding 2 to 3 times as many shells per man, per machine, using "Standard" rapid-rapping Swagers

Actually, the savings from using the high speed feeding fixture and Standard Swager shown are fourfold:

1. Production Increased—2 or 3 times over other methods;
2. Improved Physical Characteristics of Band—100% above elongation specification; and 15-20% above tensile strength tolerance;
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4. Easier to finish turn—because swaging leaves the outside diameter of the finished band smooth.

4500 impact blows per minute attach band to shell by flowing the material, whether gilding metal or pure copper, into the knurling and undercut sides of band groove walls.

These simple facts not only tell an important defense story, but tell a story typical of results which users report after bringing their metal-forming problems to us. May we help you? Give complete information, please. Address—

IT'S **STANDARD** PRACTICE

STANDARD MACHINERY COMPANY

PROVIDENCE, RHODE ISLAND

Important Properties of Electrical Insulating Papers

(*Continued from Page 451*)

applied to 100 per cent of the material not only to control mill production but also to locate and eliminate defective sections. For this reason, the pulp for this type of paper must also be passed through centrifugal separators.

✦ ✦ ✦

THE surface finish is important in certain types of applications. In some cases it is necessary that the surface be sufficiently rough to hold the wire in place and prevent collapsing. In other cases a smooth surface is desirable in order that the wires may be slipped into the proper position at the time of winding. For different applications, papers are required having rough, machine-calendered, supercalendered, glaze-rolled, and water finishes.

✦ ✦ ✦

THIS type of paper may be made on both Fourdrinier and cylinder machines. The latter machines are used particularly when papers must be supplied with high stretch in the crosswise direction in order to withstand the folding operations required in the assembly of units such as transformers. The pulps used are generally kraft or rag.

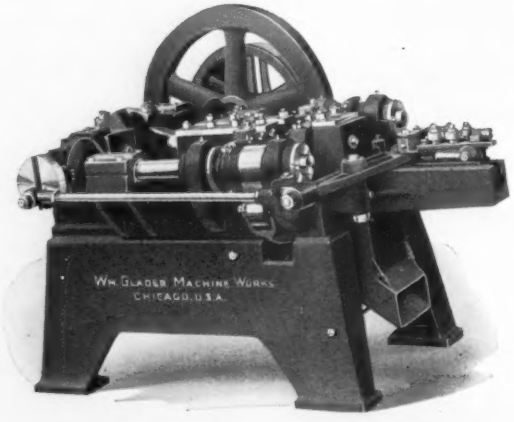
✦ ✦ ✦

PRESSBOARDS. Pressboard is a material of wide application in the manufacture of electrical equipment as a spacing and insulating medium. True electrical pressboard in the commonly accepted meaning of the term, includes only that material ranging in thickness from 0.005 in. to 0.125 in. made in the form of sheets on a wet machine. There is, however, a considerable amount of board used as insulation which is laminated from thinner sheets to give the required thickness. The latter does not have the necessary stretch and pliability to be used in many cases where the material must be molded or formed at sharp angles. The thinner pressboards up to approximately 0.032 in. have in recent years been made on a cylinder machine in continuous rolls. In the manufacture of many forms of equipment, the process is simplified by having the pressboard in the form of rolls which can be fed through automatic machinery. It was to meet this need that continuous rolls of so-called pressboard were developed. It should be pointed out that this material, dried over drier rolls under tension, is not equivalent in all respects to the sheet form which has been dried under conditions where free shrinkage in all directions is possible. The writers are of the opinion that the word "presspaper," whch has been applied by some manufacturers to the roll form, should be commonly adopted to avoid confusion.

✦ ✦ ✦

THE pulps used range all the way from 100 per cent rag through various combinations of rag and wood pulp to 100 per cent kraft fiber. In the thinner sheets it has usually been 100 per cent rag or a 50-50 mixture of rag and kraft. In the thicker pressboards 75 per cent rag and 25 per cent kraft fiber are commonly used.

GLADER WIRE NAIL MACHINE SCORES AGAIN



WM. GLADER MACHINE WORKS

210 N. Racine Ave. Chicago, Illinois

A prominent wire mill on the west coast is adding over 100 machines to their present GLADER installation.

The production figures on common nails shown below, are guaranteed.

SIZE MACH.	SIZE WIRE	MAX. LENGTH OF WIRE	NUMBER OF NAILS PER MIN.	CAP. IN POUNDS PER HR.
#00A	#16	1⅛"	700	37.2
#00	#14	1¼"	550	55
#0	#12	1¾"	450	89
#1	#10	2½"	400	192
#2	#8	3½"	325	310
#3	#4	5"	225	523
#4	#1	7"	190	622
#4s	5/16"	9"	175	1155
#5	⅜"	12"	160	2400

This high output and economical operation account for the GLADER machine being accepted as standard equipment in all recent installations.

THERE are two finishes in general use. These are glaze-rolled finish and a calendered finish. The former is applied to pressboard up to about 0.025 in. in thickness, while the latter finish has been used on all thicknesses.

✦ ✦ ✦

THE most important requirements in electrical pressboards are high dielectric strength, toughness, moldability, uniformity of thickness, and freedom from impurities. Referring to the last requirement, experience has shown that sodium and aluminum resinates resulting from the use, in pressboard manufacture, of scrap papers sized with rosin and alum, cannot be tolerated because of their contaminating influence on impregnating liquids such as Pyranol.

Chemical Deterioriation of Paper Insulation

MOST electrical insulating materials are operated at elevated temperature; in fact, the temperature limits around which electrical apparatus is designed might be raised considerably with attendant savings in size and material cost if insulating materials did not deteriorate with time at elevated temperatures. Therefore, pyrolysis or the integrated time effects of prolonged heating are of extreme importance.[15] The conditions under which electrical insulation is operated are extremely varied. Many machines are open to air so that oxidation is an important factor in chemical deterioration. Other types of apparatus, such as capacitors, cables, and hydrogen-cooled generators are essentially oxygen-free. Nevertheless, all cellulosic materials deteriorate with time at elevated temperatures even though oxygen is absent. Many accelerated tests have been devised to show the rela-

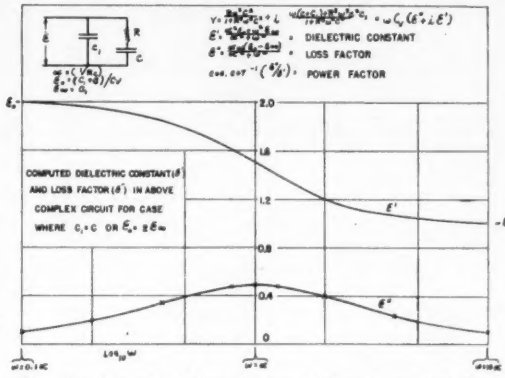


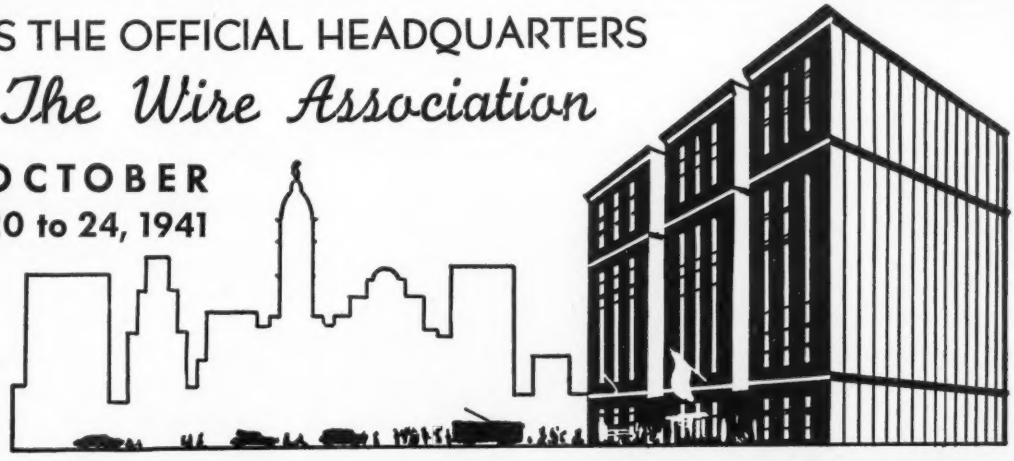
Fig. 10. General relations between dielectric constant, loss factor, and frequency in a dielectric showing electrical relaxation properties.

✦ ✦ ✦ ✦

(15) J. J. Smith and J. A. Scott: Elec. Eng. 58, 456, Sept. 1939.
(16) H. H. Race: Discussion, Elec. Eng. 58, 456, Sept, 1939.
(17) H. H. Race: AIEE Preprint No. 39-113.

(*Please turn to Page 470*)

IT'S THE OFFICIAL HEADQUARTERS
The Wire Association
OCTOBER
20 to 24, 1941



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FINE WIRE SPOOLS

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Non-Snag winding, light weight, safe and convenient shipping of your fine wires—these are advantages of using an All-Metal Clark Spool. The reasons for these advantages are to be found in the design, construction, and materials used in the spool:

Metals tested for maximum rigidity.

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Full curl on ends—no rough edges.

Identifying copy embossed in ends.

Finish—gold or copper lacquer, or a variety of colored lacquers.

Spool sizes: 2-7/16″ or 3″ diameter ends; 2-7/16″ size made with 1½″ diameter barrel only, the 3″ diameter with 1½″ or 1¾″ diameter barrel; length of barrel to suit your winding needs.

We will send samples at your request.

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The *Trauwood* PROCESS

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Higher and more uniform physical and fatigue properties.

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Thermal efficiency of the process very high.

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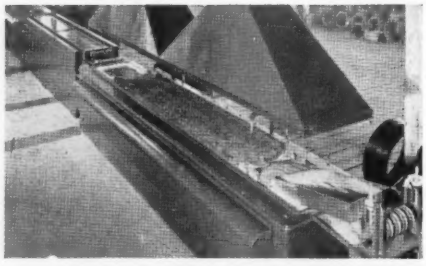
Adaptable to high alloy and austenitic steel wire and strip (annealing of stainless).



The Trauwood Process, new in principle, eliminates high temperature furnaces and lead pots with their excessive maintenance costs and low thermal efficiencies. More positive temperature control is possible and quenching is done in a RISING temperature—instead of falling, as in conventional heat treating methods. The rapid rate of heating (4 to 5 times as fast as furnace heating) increases production and uniformly produces a finer grained product with higher physical and fatigue values.

Wire and rod patented by the Trauwood Process insures easier drafting and makes heavier reductions possible. In conjunction with the Trauwood patenting equipment, pickling, coating and baking can be made continuous, eliminating expensive handling and delay, materially reducing costs as compared with ordinary methods.

Complete details of the Trauwood Process will be furnished you on request. Our engineers will help you solve your continuous wire and strip patenting, tempering, and annealing problems. Write today.

THE TRAUWOOD ENGINEERING COMPANY

1740 E. 23rd STREET, CLEVELAND, OHIO, U.S.A.

Important Properties of Electrical Insulating Papers

(*Continued from Page 469*)

tive stabilities of different insulation systems at elevated temperatures, but few quantitative data are available showing the chemical reactions and their rates which contribute to such deterioration.[16]

✦ ✦ ✦

IN oxygen-free oil-impregnated paper operating at high electrical gradients and at 100 C chemical reactions with metals which were not anticipated and localized deterioration leading to high dielectric losses and eventual failure[17] have been found. Since the mineral oil, if oxygen-free, does not deteriorate appreciably under these conditions even in the presence of metals, it is suspected that such deterioration results from decomposition of the paper.

✦ ✦ ✦

FOR these reasons it is believed that in the future considerable effort should be expended on chemical studies of rates of decomposition of paper and other organic insulating materials with and without oxygen with the hope of learning how to materially reduce the rate of decomposition at operating temperatures.

✦ ✦ ✦

THE writers wish to acknowledge the assistance of a number of individuals, particularly M. Guarnier and S. I. Reynolds, in obtaining some of the data presented.

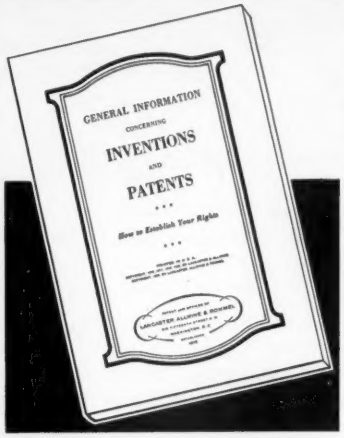
✦ ✦ ✦

Jones & Laughlin Expand Muncy, Pa., Plant

AN extension to its present wire rope plant at Muncy, Pennsylvania, and the installation of additional equipment, has been authorized by the Jones & Laughlin Steel Corporation, Pittsburgh.

✦ ✦ ✦

IT is expected that work will be started this week on a 120 x 275 foot addition to the plant to house a new closing machine which fabricates the strand into finished rope, and to provide warehouse space. A new office building is also being constructed on the property. The present plant was completed in June of 1938.



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By MAURICE BONZEL

✦ ✦ ✦

Translated and Published by

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495 pages—414 illustrations

✦ ✦ ✦

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WIRE and WIRE PRODUCTS

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Drever Company Issues New Bulletin

TWO new folders of interest to wire mills have just been issued by the Drever Company. One of these, Bulletin B-3, illustrates and describes briefly their furnaces for bright annealing stainless steel wire, for general annealing, for bright annealing tubing, for clean hardening and so forth. The second, B-5, covers the Drever ammonia dissociator, used for producing a hydrogen-nitrogen furnace atmosphere in connection with brazing, annealing or bright hardening, to eliminate surface oxides and inter-granular oxidation. This bulletin also describes a purification unit for industrial gases and supplementary equipment for ammonia dissociation.

✦ ✦ ✦

IF copies of bulletins are desired, please address The Editor, Wire & Wire Products.

✦ ✦ ✦

Determination of Spheroidizing Cycles in New Annealing Department

(*Continued from Page 440*)

change the temperature but did allow the soaking time to be varied for two charges, one 4200 lbs. or less and the other 4500 lbs. or more. All data was tabulated and graphed for each steel analysis and these charts served as standards.

✦ ✦ ✦

THIS, as indicated, was a fairly long and comprehensive study but the results of it was utmost economy of time and fuel, excellent uniformity throughout the charge and consistently good results from the equipment. For the operators, these results were condensed into a single page of tabulated instructions to set the total furnace time for the material analysis and charge weight involved in each heat. This information is on the charge ticket and that is all the operator needs to know to run his cycle.

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If you make wire novelties to which various finishes are applied . . . if you are experiencing difficulties in securing the results and quality of work called for by specifications, consult our Service Representative in your locality.

Whether the product is plated, painted, enameled or otherwise finished, you will find Oakite cleaning materials and methods can help you prepare it for subsequent operations and finishes so that production runs smoothly, output is at required volume and costs within specified limits.

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Write for further information. We may be able to solve your difficulties.

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WIRE & WIRE PRODUCTS
300 Main Street Stamford. Conn.

American Steel & Wire Expands

PLANS for rehabilitation, consolidation and expansion of facilities for the manufacture of rods, wire and wire products in the company's plants at Joliet and Waukegan, Illinois, have been announced by C. F. Hood, President of American Steel & Wire Company, subsidiary of United States Steel Corporation.

✦ ✦ ✦

THE program includes the construction of a new coarse rod mill and a new mill for the manufacture of merchant products at the Collins Street plant in Joliet, which upon completion will replace the present facilities at the Rockdale and Scott Street plants in the same city.

✦ ✦ ✦

THE new rod mill at Joliet will be adjacent to the present rod mills and eventually will replace the existing Waukegan rod mills. Present billet storage and shipping facilities will be enlarged to accommodate the new mill. Rod production thus will be increased somewhat by the installation. While the wire drawing capacity of the Joliet plant will not be greatly enlarged, the new facilities will permit increased production and an improved product for the merchant trade. Heat treating equipment for both rods and wire is included in the new mill. The new buildings at Joliet will include a structure with a total length of 480′ and a width of 150′ on one end and 80′ on the other to house the rod mill, together with a new conveyor building 30′ by 730′. The wire mill will be trapezoidal in shape with approximate dimensions of 1500′ by 960′. New floor space in the Joliet project will amount to over 1,100,000 square feet.

✦ ✦ ✦

AT Waukegan, replacements, rearrangements and improvements will be made to increase the efficiency of the existing mill and make it one of the most efficient units for the production of manufacturers' wire in the country.

✦ ✦ ✦

THE Waukegan program includes provisions for adequate rod storage, replacement and relocation of rod patenting equipment, replacement of heat treating equipment, replacement and relocation of straightening and cutting and tinning equipment additional continuous wire drawing and finishing equipment, improvements and replacements in the spring mill to afford better arrangement and versatility in manufacture, replacement of cleaning house and of iron sulphate facilities, extension to warehouse space, and an addition to the present office building.

✦ ✦ ✦

NEW buildings will include an electro galvanizing building 37′ by 525′, a straight and cut building 70′ by 355′, and a sulphate of iron building 60′ by 250′. Also to be constructed are two additions to present rod storage facilities, 60′ by 420′, and 210′ by 340′. Expansion of warehouse facilities also will be provided through the construction of four additions to present buildings. The addition to the office building will be two stories, 39′ by 100′. The total amount of new floor space will add up to over 183,000 square feet.

Sheffield Steel Announces Additional Plant Capacity

A WIDE range of steel products will be produced in the new 17 million dollar steel mill now under construction on the ship channel at Houston, Texas by the Sheffield Steel Corporation of Texas.

✦ ✦ ✦

THOSE products will include merchant bars and shapes, reinforcing steel, tie plates, structurals, sheets and plates, fence, nails and manufacturers' wire.

✦ ✦ ✦

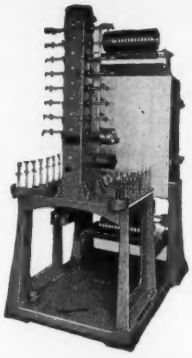
GROUND was broken last month for the new plant, which will have an ingot production of 200,000 tons per year and will employ some 1,500 men at the start. The plant is expected to be in operation shortly after the first of next year.

✦ ✦ ✦

THE new plant actually is an expansion of present Sheffield production facilities at Kansas City, St. Louis and Tulsa, to serve an important Texas trade. Three open hearth furnaces, billet mills and finishing departments will be utilized in initial steel production, and finishing departments will include a structural and tie plate mill, merchant bar mill, reinforcing and rod mills, wire plant and hot rolled sheet and plate mills.

✦ ✦ ✦

THE Kansas City plant of the Sheffield organization, which is a subsidiary of the American Rolling Mill Company, also has announced expansion plans totaling 1 million dollars (following on the heels of a recent 3 million dollar development) which will provide a fifth open hearth furnace and increase steel production by 25 per cent. Three shifts are working seven days a week in most Sheffield departments at Kansas City. This Sheffield unit is given credit for developing methods of utilizing 100 per cent iron and steel scrap in the production of steel — an important accomplishment in areas with huge scrap reserves and far removed from iron ore deposits.



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WIRE ENAMELING MACHINE

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Finished Wire Spindles Individually controlled.

Traverse is Adjustable for Different Spool Dimensions.

Ease of operation and number of spindles one operator can tend give low cost for enameling wire.

Self-Contained on Bed-Plate.

Motor Driven.

Motor included.

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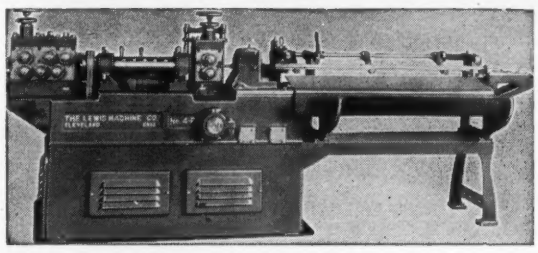

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Outstanding Personalities of the Wire Industry

(*Continued from Page 453*)

MARCUS W. WHITE retains the position of purchasing agent, which he has held with the company for many years.

✦ ✦ ✦

Vascoloy-Ramet Opens New York Office

A DISTRICT sales engineering office at 50 Church Street, New York, was opened July 10 by Vascoloy-Ramet Corporation, North Chicago, Illinois, manufacturers of tantalum-tungsten carbide tools, blanks, dies and wear resisting parts. Sales and service for the New York area had been handled previously from the Vascoloy-Ramet eastern plant in Jersey City.

✦ ✦ ✦

IN charge of the New York office is **Eugene Roth,** eastern district sales manager, assisted by **Alan Carver, Harry J. Chase** and **Standish Rowe.**

✦ ✦ ✦

OTHER factory-owned Vascoloy-Ramet branches are at Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Hartford, Milwaukee, Philadelphia, Pittsburgh, Providence, St. Louis and Syracuse.

✦ ✦ ✦

A. St. Claire Ryley, General Manager, Canadian Steel Corp., Ltd.

THE Canadian Steel Corp., Ltd., announces the appointment of **Mr. A. St. Claire Ryley** as General Manager succeeding Mr. F. H. Kester, resigned. Mr. Ryley is General Manager of the Dominion Steel & Coal Corporation interests in the Ontario area. These interests consist of the Canadian Bridge Company, Ltd.; the Essex Terminal Railway Company; the Canadian Steel Corporation, Ltd.; and The Canadian Steel Lands Company.

✦ ✦ ✦

MR. RYLEY is a member of the Wire Association.

F. H. Adams Elected President, Surface Combustion Corp.

FRANK H. ADAMS, for 15 years vice president and general manager of Surface Combustion Corporation, has been elected president succeeding **Henry L. Doherty,** deceased.

✦ ✦ ✦

VIANNEY

Famous Wire Drawing Diamond Dies

These famous Diamond Dies are now produced here at moderate prices.

All sizes are in stock or made to order to your specifications

VIANNEY WIRE DIE WORKS

250 E. 43rd. St. New York.
V. J. Boulin, Manager

Wire Drawing and Extrusion Dies made of DIAMONDS, COMPOSITION, etc.
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250 Ogden Ave. Jersey City, N. J.
Phone JOurnal Square 4-5105

FOR **DIAMOND** AND **CARBIDE WIRE DRAWING DIES** SEE
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275 Seventh Ave., New York, N. Y.

Diamond Dies for Wire Drawing
Wayne Wire Die Co., Inc.
133 Mountain Rd.
Jersey City, N. J.
Tel.: Journal Square 4-4311

DIAMOND DIES
.000's to .102
Fort Wayne Wire Die, Inc.
2002 S. Harrison Fort Wayne, Ind.

DIAMOND CARBIDE
DIES
KELLY
WIRE DIE CORPORATION
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DIES BY WILLEY'S

Tungsten Carbide Sizing, Extrusion, and Wire Drawing Dies can be furnished standard or to your specifications. Write for catalog #25.

Sales engineers in all principal cities.

Thousands in daily use producing maximum results in mass production plants.

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Wire Drawing Diamond Dies
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WIRE DIE CORPORATION
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Tel. Col. 5-1340

UNIVERSAL WIRE REEL

Quickly and easily adjusted to any angle within 90 degrees. Cut shows one angle.
Write for circular R

THE F. B. SHUSTER CO.
New Haven, Conn.
Straightener Specialists Since 1866

Continuous Straightening and Cutting Machinery
with
FLYING SHEAR
for round and shaped wire.
✦ ✦ ✦
THE HALLDEN MACHINE COMPANY
THOMASTON CONNECTICUT

Wire Drawing Machinery
Featuring —
High Speed Upright Cone Machines.
Also —
Bull Blocks and Benches, Continuous Wire Drawing Machines, Spoolers, Pointers, String-up Machines, etc.
And —
Cold Heading Machinery.
WATERBURY FARREL FOUNDRY & MACHINE CO.
Waterbury, Conn.

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the original Frank Mossberg Co.
Manufacturers of Reels and Spools
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Chilled Iron, Alloy Chilled Iron, Alloy Iron, Dry Sand, Meehanite, Steel, Chromium-Plated, Flame Hardened. For all purposes. Any diameter from 4" to 72". Any length up to 312" face. Complete pattern-making, foundry, machining, welding and annealing facilities also available.
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Division of
THE CLEVELAND CRANE & ENGINEERING CO.
WICKLIFFE, OHIO
Leading manufacturers of
OVERHEAD MATERIALS HANDLING EQUIPMENT
for the Wire and Wire Products Industry

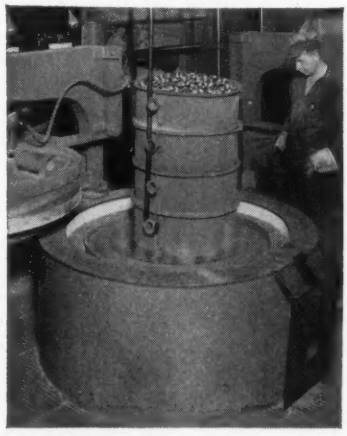
New Booklet of Interest to Heat Treaters

SO that everyone interested in carburizing can become familiar with a method, now used in many heat-treats, which is said to put a case of specified thickness on a variety of work — gears, spindles, bearing-cones, bushings, camshafts, etc. — the Leeds & Northrup Company has issued a 28-page catalog—"Homocarb Method for Carburizing".

✦ ✦ ✦

DIFFERENT from most carburizing publications, this book gives a pictorial representation of heat-treats, shows furnaces in action, various types of work being carburized, and tells how results are obtained.

✦ ✦ ✦



IN addition to action photos, there are diagrams, charts and photomicrographs which illustrate how and why this method enables a heat-treater to secure a predetermined case.

✦ ✦ ✦

ANYONE who wants a copy of this catalog, T-623, may have it by addressing the Editor, Wire & Wire Products.

BRODEN
Wire Mill and Cold Rolling Equipment
Broden Construction Co.
22800 Lakeland Blvd.
CLEVELAND, OHIO

SCOTT TESTERS
For WIRE, RUBBER, TEXTILES, PAPER, Etc.
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43 Midland St., Worcester, Mass.
Phone: Worcester 5-6033

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2—Baird No. 3 & S3F 4 Slide Wire Machines
7—Waterbury Step Cone Wire Drawing Machines
1—Two Spindle Bull Block Motor Driven
6—Lewis Welding Wire S & C Machines M. D.
2—Shuster Shaped Wire S & C Machines ½" & ⅞"
8—Shuster Round Wire S & C Machines 1/32"-½"
Wanted: Tack Making Machinery. All Sizes.
NATIONAL MACHINERY EXCHANGE
128-138 MOTT ST. NEW YORK, N. Y.

Hy-Carbo Steel Co.
EST. 1917
✦ ✦ ✦
HIGH GRADE CUSTOM WIRE DRAWING
In Rounds
Less Ton Lots A Specialty
✦ ✦ ✦
LOWELL, MASS.

Annealing Pots and Boxes
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Pressure Vessels
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PRODUCTIMETERS
Precision-built for accuracy and speed. Most complete line offered.
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ZINC WIRE
ZINC STRIP
THE PLATT BROS. & CO.
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Machinery For
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WIRE DRAWING MACHINERY AND EQUIPMENT
Rod Frames — 16" Frames, 8" Frames — Take-Up Frames, Wire Pointers — Puller Tongs.
General Castings for Wire Mill use. Circulars on Request.
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CHEMICALS ACP PROCESSES
Use Rodine in the Pickling Bath to Prevent Smudging and Acid Brittleness.
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TILTING WIRE REEL
One man loading reel = for wire coils up to 300 pounds.
MOSLO MACHINERY, INC.
CLEVELAND, OHIO

ACID PROOF BRICK
for
Pickling Tank Construction
Toronto Acid Brick
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STEUBENVILLE, OHIO

STEEL STEVENS REELS
FOR
WIRE AND CABLE INDUSTRY
STEVENS METAL PRODUCTS CO.
NILES, OHIO.

United States Rubber Company To Manufacture "Assault Wire" For Army

"ASSAULT wire" for the Army — multiple thousands of miles of military telephone wire—is to be manufactured in this Rhode Island industrial town of Bristol, it was annuounced by United States Rubber Company. Involved also is the reconstruction of re-equipment of a currently idle factory in order to manufacture the vast order.

✦ ✦ ✦

THE announcement followed recent word from Washington that the United States Government's Defense Plant Corporation and the Army Signal Corps had entered into agreements with United States Rubber Company for both the plant and the wire. It was estimated that more than $3,143,000 worth of this combat type of wire is involved, and more than $700,000 is to be invested in reconstructing and re-equipping the building to be used.

✦ ✦ ✦

THE wire is an extraordinary new combat wire developed over the last 15 years by the Army Signal Corps and the rubber company, using a new process of the company. It is said to be greatly superior to any similar purpose military wire in the world. The United States Rubber Company has also licensed other companies to produce the new wire.

✦ ✦ ✦

THE new type wire weighs between 28 and 29 pounds per mile—as compared with the old type used by the Army, which weighed about 160 pounds to the mile. Since "Assault wire" is the type of field telephone wire commonly carried in reels on the backs of soldiers as they advance in combat, unreeling it as they run in the advance, the weight-saving represents an enormous advantage.

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and
CREPE PAPER
In rolls of any size for wrapping coils and reels.
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PATERSON N J
BUILDING EXTRUDERS SINCE 1880
Insulating Machinery for Western Electric Continuous Vulcanizing process.
JOHN ROYLE & SONS
PATERSON, N. J.
British Agency: James Day (Machinery) Ltd., The Grange Whetstone Nr. Leicester, England

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WINDING AND SPECIAL MACHINES
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INSULATED WIRE AND RUBBER HOSE
JAMES L. ENTWISTLE
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SPARKERS
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Wallingford, Conn.

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THOMSON-JUDD
WIRE MACHINERY COMPANY
SUBSIDIARY OF
THOMSON-GIBB ELECTRIC WELDING COMPANY
LYNN, MASSACHUSETTS
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WHERE TO BUY

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Norton Co., Worcester, Mass.

ACCUMULATORS—
Farrel-Birmingham Co., Inc., Ansonia, Conn.

AIR DRAW FURNACES—
Carl-Mayer Corp., The, Cleveland, Ohio.

ANNEALING MACHINES—Open Flame
Syncro Machine Co., Rahway, N. J.

ANNEALING POTS AND BOXES—
National Annealing Box Co., Washington, Penna.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.

ARMORING EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

AUTOMATIC SPARK TESTING EQUIPMENT—
Entwistle, James L., Pawtucket, R. I.

BAKERS—Hi-Speed
Carl-Mayer Corp., The, Cleveland, Ohio.

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Moslo Machinery, Inc., Cleveland, O.
Ross, J. O., Engineering Corp., New York, N. Y.

BANBURY MIXERS—
Farrel-Birmingham Co., Inc., Ansonia, Conn.

BERYLLIUM COPPER — Strip and Bars
Callite Tungsten Corp., Union City, N. J.

BLOCKERS—
Farrel-Birmingham Co., Inc., Ansonia, Conn.

BOBBINS—Braider and Wire Weaving
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

BORON CARBIDE—
Norton Co., Worcester, Mass.

BRICKS—Acid Proof
Keagler Brick Co., Steubenville, Ohio.

CALIPERS—Roll
Farrel-Birmingham Co., Inc., Ansonia, Conn.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CASTINGS—Wire Mill
Farrel-Birmingham Co., Inc., Ansonia, Conn.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANERS—Hand and Metal
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANING & PICKLING EQUIPMENT—
Broden Construction Co., Cleveland, O.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engineering Co., Cleveland, Ohio

CLOTH TESTERS—
Scott, Henry L., Co., Providence, R. I.

CLOTH—Wire, All Metals
Callite Tungsten Corp., Union City, N. J.

COATING—Protective
American Lanolin Corp., Lawrence, Mass.

COILERS—Sheet, Strip and Wire
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.

COILERS AND SPOOLERS FOR INSULATED WIRES—
Entwistle, James L., Pawtucket, R. I.

COLD HEADERS—
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

COMPOUNDS—Wire Drawing
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

WHERE TO BUY, Continued

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Vascoloy-Ramet Corp., North Chicago, Ill.

DIAMONDS—Industrial
Callite Tungsten Corp., Union City, N. J.

DIAMOND POWDERS—
Rusch Wire Die Corp., New York, N. Y.

DIAMOND TOOLS—
Rusch Wire Die Corp., New York, N. Y.

DIES—Diamond
Cochaud Wire Die Corp., New York, N. Y.
Fort Wayne Wire Die, Inc., Fort Wayne, Indiana
Kelly Wire Die Corp., New York, N. Y.
Krause, F., & Co., Inc., Jersey City, N. J.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Jersey City, N. J.

DIES—Lead Extrusion
Robertson, John, Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Carboloy Co., Inc., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Fort Wayne Wire Die, Inc., Fort Wayne, Indiana
Kelly Wire Die Corp., New York, N. Y.
Krause, F., & Co., Inc., Jersey City, N. J.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Jersey City, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Rod and Tube Drawing
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tantalum Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.

DIES—Tungsten Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIRECT ELECTRIC RESISTANCE HEAT TREATING
Trauwood Engineering Co., Cleveland, Ohio

DRAW BENCHES—
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.
Standard Machinery Co., Providence, R. I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Stevens Metal Products Co., Niles, O.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

ENGINEERS—Consulting Wire Mill
Hartley, George D., Worcester, Mass.
Lewis, Kenneth B., Worcester, Mass.

EQUIPMENT—Insulation Testing
Davis, R. L., Electric Co., Wallingford, Conn.
Entwistle, James L., Pawtucket, R. I.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FLASH BAKER—
Carl-Mayer Corp., The, Cleveland, Ohio.

FURNACES—Annealing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., Cleveland, Ohio
Wilson, Lee, Engineering Co., Cleveland, Ohio

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engineering Co., Cleveland, Ohio

FURNACES—Brazing
Electric Furnace Co., Salem, O.
Firth-Sterling Steel Co., McKeesport, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engineering Co., Cleveland, Ohio

FURNACES—Electric
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., Cleveland, Ohio

FURNACES—Hardening and Tempering
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., Cleveland, Ohio

FURNACES—Lead Melting
Electric Furnace Co., Salem, O.
Robertson, John, Co., Brooklyn, N. Y.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Non-Oxidizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Normalizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Salt Bath
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engineering Co., Cleveland, Ohio

GALVANIZING EQUIPMENT—
Wilson, Lee, Engineering Co., Cleveland, Ohio

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GATES—Blast, For Low Pressure Air
Farrel-Birmingham Co., Inc., Ansonia, Conn.

GEARS—Continuous Tooth Herringbone
Farrel-Birmingham Co., Inc., Ansonia, Conn.

GEARS—Wire Mill
Farrel-Birmingham Co., Inc., Ansonia, Conn.

GRINDERS—Roll
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Norton Co., Worcester, Mass.

HI-SPEED BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio.

HOISTS—Flectric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

INSTRUMENTS—Electrical
Entwistle, James L., Pawtucket, R. I.

KETTLES — Galvanizing, Annealing, Tinning, etc.
Farrel-Birmingham Co., Inc., Ansonia, Conn.

LATHES—Die Reaming
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

LUBRICANTS—For Metal Cutting Stamping and Drawing
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

MACHINERY — Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Robertson, John, Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.

MACHINERY—Bunching
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Entwistle, James L., Pawtucket, R. I.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Coilers
Broden Construction Co., Cleveland, O.
Entwistle, James L., Pawtucket, R. I.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Copper Wire Drawing and Rolling
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
Fidelity Machine Co., Philadelphia, Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Cutting
Broden Construction Co., Cleveland, O.
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, O.
Moslo Machinery, Inc., Cleveland, O.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Shuster, F. B., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Die Making
Firth-Sterling Steel Co., McKeesport, Pa.

MACHINERY—Draw Benches
Standard Machinery Co., Providence, R. I.

MACHINERY—Edging
Standard Machinery Co., Providence, R. I.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Extruding
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Robertson, John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

WHERE TO BUY, Continued

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, O.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Forming
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.

MACHINERY—Galvanizing
Wilson, Lee, Engineering Co., Cleveland, Ohio

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engineering Co., Cleveland, Ohio

MACHINERY—Gang Winders
Fidelity Machine Co., Philadelphia, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Grinding, Roll
Farrel-Birmingham Co., Inc., Ansonia, Conn.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Lead Encasing
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Robertson, John, Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John, Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Material Handling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

MACHINERY — Measuring Wire & Cable
Davis, R. L., Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Paper Covering Wire
Terkelsen Machine Co., Boston, Mass.

MACHINERY—Pointing
Broden Construction Co., Cleveland, O.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Rubber for Insulating Wire
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Rubber Strip Covering
Farrel-Birmingham Co., Inc., Ansonia, Conn.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
Farrel-Birmingham Co., Inc., Ansonia, Conn.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I. (Special Designs)
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, O.
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, O.
Moslo Machinery, Inc., Cleveland, O.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Shuster, F. B., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Stranding
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, O.
Ruesch, H. J., Machine Co., Newark, N. J.

Machinery—Swaging
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing
Entwistle, James L., Pawtucket, R. I.
Scott, Henry L., Co., Providence, R. I.

MACHINERY—Testing Size of Wire
Davis, R. L., Electric Co., Wallingford, Conn.

MACHINERY—Testing—Spring
Standard Machinery Co., Providence, R. I.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y. Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Welding Wire
Micro Products Co., Chicago, Ill.
Shuster, F. B., Co., New Haven, Conn.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Entwistle, James L., Pawtucket, R. I.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, O.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Wire Measuring
Durant Mfg. Co., Milwaukee, Wis.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Tinning
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Wood Screw
National Machinery Exchange (Used), New York, N. Y.

MACHINERY—Wrapping Wire
Terkelsen Machine Co., Boston, Mass.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

MILLS—Rod, Bar, etc.
Farrel-Birmingham Co., Inc., Ansonia, Conn.

MILLS—Strip, Hot and Cold For Iron, Steel, Copper, Brass, etc.
Farrel-Birmingham Co., Inc., Ansonia, Conn.

MILLS—Tandem Rolling and Edging
Standard Machinery Co., Providence, R. I.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Standard Industrial Compounds Co., Chicago, Ill.

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

WHERE TO BUY, Continued

PAPER—Creped Wrapping
Crepe-Kraft Co., Inc., Newark, N. J.

PAPER TESTERS—
Scott, Henry L., Co., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PICKLING TANK LININGS—
Keagler Brick Co., Steubenville, Ohio.

PLASTIC TESTERS—
Scott, Henry L., Co., Providence, R. I.

POTS—Lead Melting
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Robertson, John, Co., Brooklyn, N. Y.

PRESSES—Hydraulic and Mechanical
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Providence, R. I. (Mechanical Only)

PRESSES—Lead
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS—Wire
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

RECORDERS—Fault and Reel
Entwistle, James L., Pawtucket, R. I.

REEL AND TENSION STAND—
Fidelity Machine Co., Philadelphia, Pa.
Moslo Machinery, Inc., Cleveland, O.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS—Annealing and Stranding
American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, O.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Constant Tension
Farrel-Birmingham Co., Inc., Ansonia, Conn.

REELS—Steel
American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS AND SPOOLS—Shipping and Shop
American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS—Takeoff
American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, O.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Vulcanizing and Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, O.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio.
Moslo Machinery, Inc., Cleveland, O.
Ross, J. O., Engineering Corp., New York, N. Y.

RODS—Wire—Non-Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Sheffield Steel Corp., Kansas City, Mo.

ROLLS—Iron, Steel, Alloy
Farrel-Birmingham Co., Inc., Ansonia, Conn.

ROLLS—For Strip, Rod, Bar Mills
Farrel-Birmingham Co., Inc., Ansonia, Conn.

ROLL STRAIGHTENERS—
Moslo Machinery, Inc., Cleveland, O.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott, Henry L., Co., Providence, R. I.

RUST PROOF COMPOUND—
American Lanolin Co., Lawrence, Mass.

SHEET—Steel
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

SOAPS—Industrial and Wire Drawing
Standard Industrial Compounds Co., Chicago, Ill.

SOLDER—
Kester Solder Company, Chicago, Ill.

SPARK TESTING EQUIPMENT—
Entwistle, James L., Pawtucket, R. I.

SPOOLS—Annealing and Wire Drawing
American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Shipping and Shop
American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Steel
American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

STAMPINGS—Steel
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Brass and Non Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

STRIP METAL TESTERS—
Scott, Henry L., Co., Providence, R. I.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TAKE-UPS FOR CABLE, HOSE, LEAD PRESSES AND SHEET RUBBER—
Entwistle, James L., Pawtucket, R. I.

TANK LININGS—Brick
Keagler Brick Co., Steubenville, Ohio.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.

TENSILE TESTERS—
Scott, Henry L., Co., Providence, R. I.

TESTING INSTRUMENTS—
Entwistle, James L., Pawtucket, R. I.
Scott, Henry L., Co., Providence, R. I.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

TREADS—Safety
Norton Co., Worcester, Mass.

TRUCKS—
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS—
Ruesch, H. J., Machine Co., Newark, N. J.

TURKS HEADS—Friction and Power Driven
Standard Machinery Co., Providence, R. I.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y. Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Micro Products Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, O.

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Sheffield Steel Corp., Kansas City, Mo.

WIRE DRAWING — High Grade Custom
Hy-Carbo Steel Co., Lowell, Mass.

WIRE—Electric
Hudson Wire Co., Ossining, N. Y.

WIRE—Enameled For Coils
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Sheffield Steel Corp., Kansas City, Mo.

WIRE—Nickel Silver and Phosphor Bronze
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.

WIRE—Non Ferrous to Specification For Special Purposes
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE SOLDER—
Kester Solder Company, Chicago, Illinois

WIRE—Spring
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Sheffield Steel Corp., Kansas City, Mo.

WIRE—Stainless Steel
Callite Tungsten Corp., Union City, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Sheffield Steel Corp., Kansas City, Mo.

WIRE AND STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE TESTERS—
Scott, Henry L., Co., Providence, R. I.

WIRE, WEAVING—Non Ferrous
Hudson Wire Co., Ossining, N. Y.

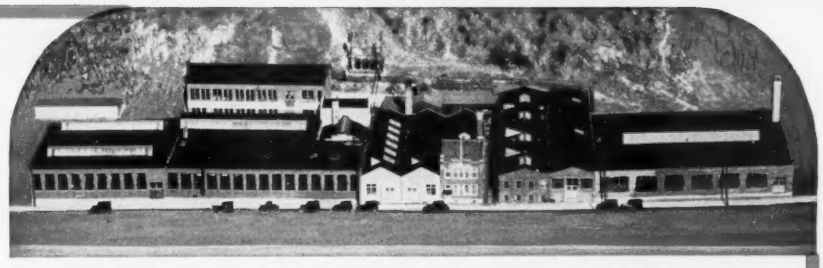
WRAPPING PAPER—Creped
Crepe-Kraft Co., Inc., Newark, N. J.

YARN TESTERS—
Scott, Henry L., Co., Providence, R. I.

HUDCO

SPECIALIZES

WINCO



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FINE BARE WIRES

High Brass, Low Brass, Zinc 99.99+ and High Tensile Zinc, Commercial Bronze, Phosphor Bronze, Pure Tin, Lead, Antimonial Lead, Tinsel Lahns, Silver Plated Copper, False Gold and Copper.

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WIRES FOR METAL SPRAYING

Pure Lead, Lead Alloy, Pure Zinc, Zinc Alloy, Copper, Tin, High Brass, Low Brass, Solder Wire, High Conductivity, Electric Wire.

Cadmium, Nickel Silver (10%, 18%, 30%); Aluminum, Monel Metal, Phosphor Bronze, Pure Nickel, Commercial Bronze.

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OSSINING, N. Y.

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WINCO AT WINSTED, CONN. PRODUCES LEAKPROOF ENAMELLED WIRE AND OTHER WINCO ENAMELLED AND COVERED WIRES.

WRITE FOR SAMPLES AND PRICES —

WINSTED DIVISION
HUDSON WIRE COMPANY
WINSTED CONNECTICUT

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